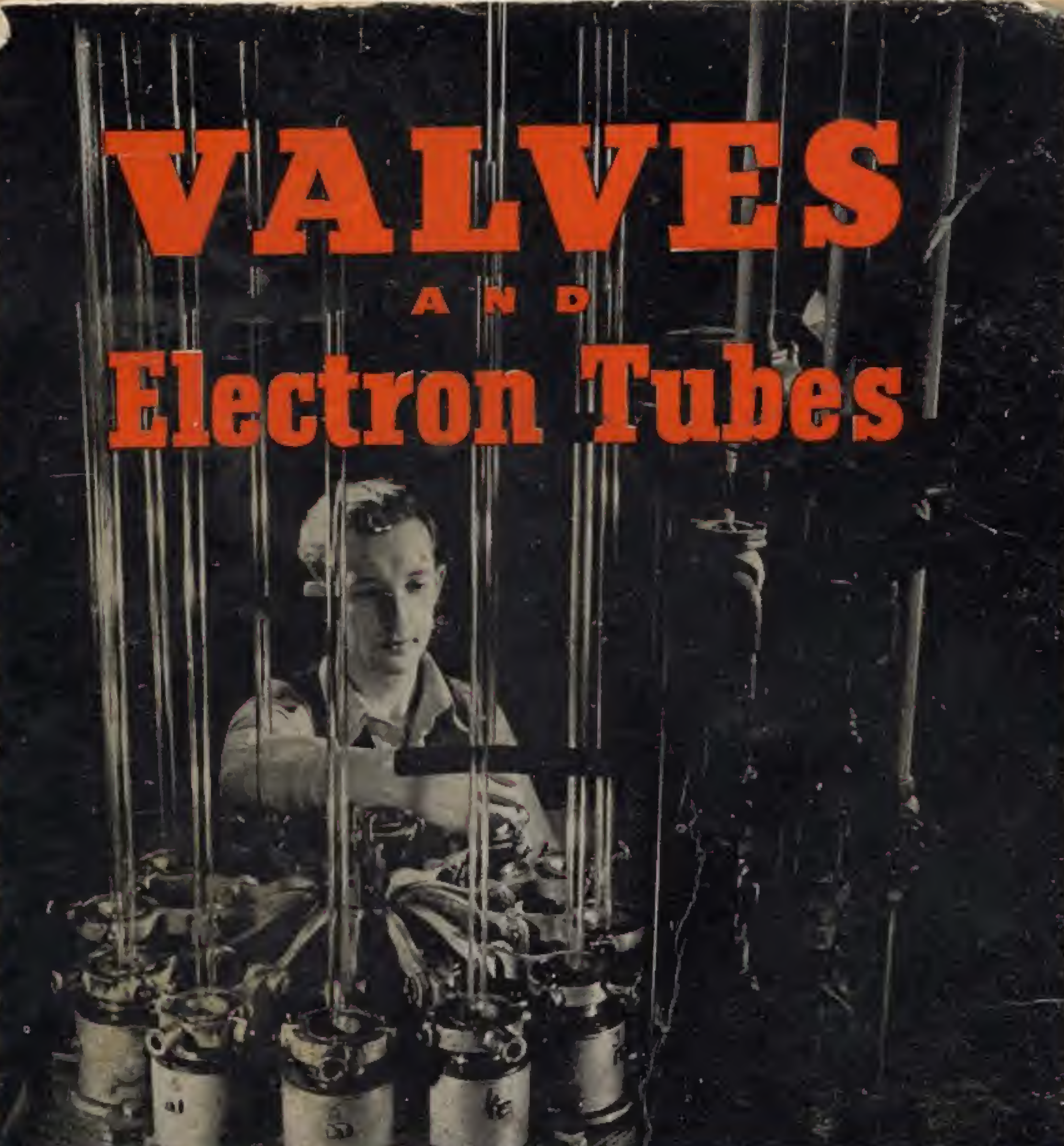
VALVES AND Electron Tubes



TECHNICAL DATA

Mullard

$5—

A CATALOGUE OF MULLARD RADIO RECEIVING VALVES AND SPECIAL ELECTRON TUBES

Mullard

MULLARD OVERSEAS LTD.,
CENTURY HOUSE, SHAFTESBURY AVE., LONDON, ENGLAND.

MVE 3319

INTRODUCTION

To millions of people throughout the world the Mullard name is associated with electronic products of the most advanced techniques and the highest quality. To those who have visited the Mullard organisation in this country, it means much more. For they have seen something of the company's extensive research facilities and great manufacturing resources.

The first few pages of this catalogue give some impression of these ramifications; we hope they will be read with interest.

For the rest, this is a catalogue of Mullard radio valves and electron tubes, and it contains descriptive details of every type in the current manufacturing programme. The most important of these to the designer of new equipment are indicated by HEAVY PRINT in the "Valve Data" section. These are the "Preferred Types" which embody the latest advances; which are in large scale production; and which will be available for maintenance for many years.

The remaining valves and tubes are, generally, normal maintenance types, the majority of which are in production or readily available from stock. A small number, however, are not being manufactured, but they have been included because they may still be available in the Trade. This means that inclusion in this catalogue of any particular type of valve or tube does not necessarily imply that it can be supplied.

It has, of course, only been possible to include abridged technical data but this should be adequate for normal requirements. Those who need more comprehensive information on the complete range of Mullard valves and tubes are invited to subscribe to the Technical Handbook Service, details of which will be found on page 66.

Advice on the use and applications of Mullard valves and electron tubes is freely available to designers and manufacturers of equipment, and to research workers. The world-wide network of Mullard distributors is constantly supplied with technical information from England, but where it is not possible for users to avail themselves of these services, they are invited to write direct to Head Office.

CONTENTS

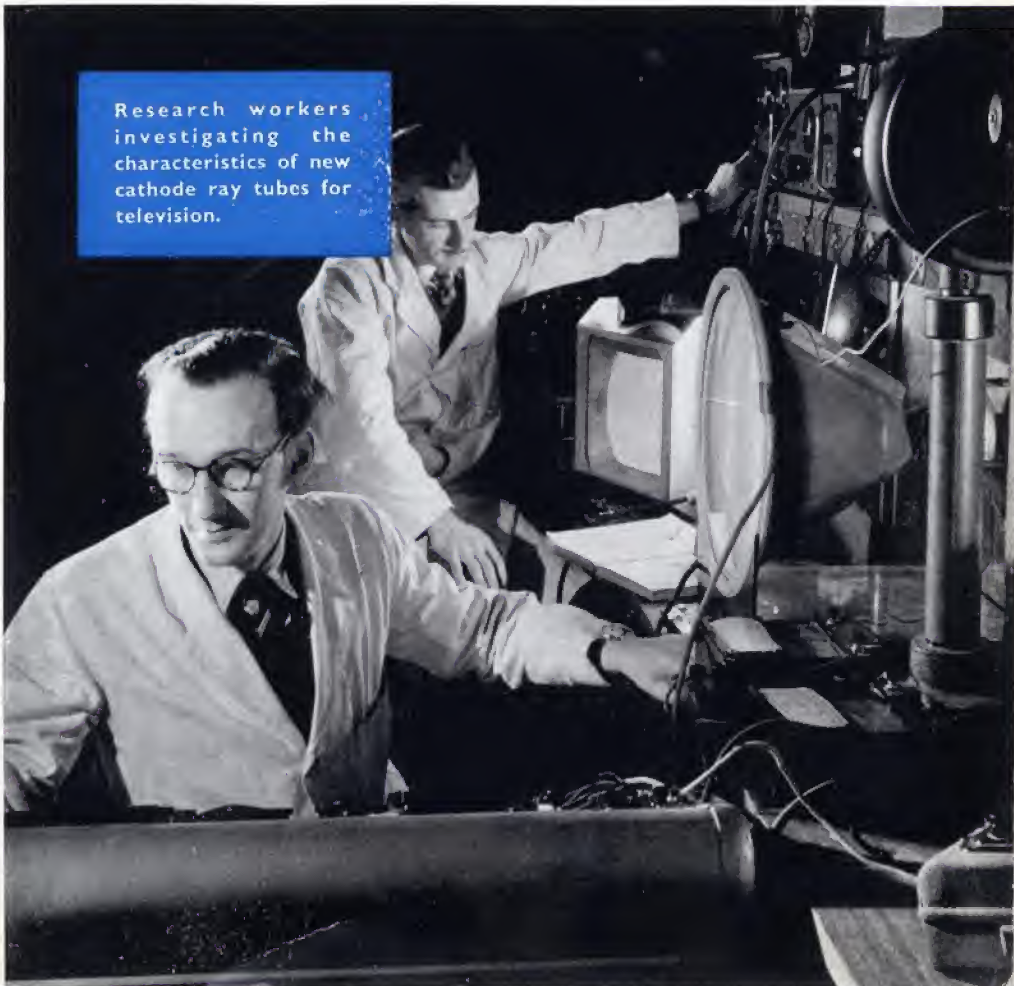
THE MULLARD ORGANISATION

The Mullard production and research organisation is the largest of its kind in the British Commonwealth. Its products range from all types of valves and electron tubes for radio, television, industry, and research to a wide variety of magnetic materials and components. For certain specialised applications complete electronic equipments are also manufactured.

The quality of these products is carefully controlled at every stage of manufacture, and in many cases processing actually starts with the raw materials. By working to these critical standards the full benefits of Mullard research are realised in the finished products.

ELECTRONICS RESEARCH

Mullard leadership in electronics is, indeed, largely due to the unceasing work of its team of research workers. Electronics research on the broadest lines is conducted in the Mullard Research Laboratory,



Research workers investigating the characteristics of new cathode ray tubes for television.

situated near Redhill, Surrey. Here physicists, chemists, metallurgists, mathematicians, engineers, and glass technologists collaborate in the design and development of new and special electron tubes, and new techniques and processes. Here, too, investigations are made of specific problems affecting the applications of electronics to other branches of research, and to the fields of industry, communications, and medicine.

Two other vitally important links in the Mullard research organisation are the Valve Measurement and Applications Laboratory and the Materials Research Laboratory, both at Mitcham, Surrey.

The Valve Measurement and Applications Laboratory collaborates with Development Departments, in the main production units, in the design of new and improved valves and cathode ray tubes. Data and circuitry resulting from this work are distributed by the Electronic Tube Department of Mullard Overseas Limited to electronic equipment designers throughout the world.

At the Materials Research Laboratory investigations are

Examining the atomic structure of a material by means of an X-ray diffraction apparatus.

Fine tungsten wire is used for the filaments of valves and electron tubes. The picture shows an early stage in wire drawing.

made into the physical and chemical properties of the great variety of materials used in the manufacture of electron tubes. This laboratory also provides a comprehensive service on materials to the Mullard factories in solving production problems and improving manufacturing processes.

WIRE AND GLASS MANUFACTURE

This emphasis on the quality of materials is vitally necessary in view of the high performance and reliability demanded of modern valves and electron tubes. To maintain the highest possible standard in the finished products it is essential to control the quality of raw materials at the earliest possible stage. The wire and glass used in Mullard valves and tubes, for example, are produced from the actual raw materials in the company's own factories at Blackburn. In this way it is not only possible to control quality throughout every stage of manufacture, but also to ensure continuity of supply.

On an average, more than five million yards of fine wire—tungsten for valve filaments, and molybdenum for grids, filament supports, and mandrils—are produced at the Blackburn plant each week. Some of this will be less than 8 microns (3/10,000th inch) diameter or 1/10th the thickness of an average human hair.

The manufacture of this wire is a fine example of the application of science to modern industry. Through a long and elaborate series of operations, a handful of powder is transformed into miles of wire, every inch of which conforms to the most exacting standards. To ensure that these high standards are maintained, the diamond dies, through which the finer wire is drawn, are also manufactured at Blackburn.

The manufacture of glass for electron tubes also involves a number of highly technical operations. In the Mullard glass plant, the raw materials —silica (sand), soda ash, potash and red lead—are converted into thousands

A high-speed, automatic machine cuts standard "sticks" of glass tubing into the lengths required for miniature valve bulbs.

of feet of glass tubing having a wall thickness controlled to tolerances as close as 1/500th inch.

From these standard "sticks" of tubing the bulbs and bases for the latest all-glass valves are made, as well as parts for the older, pinch-type valves. The Blackburn glass factory produces millions of glass components every year for distribution to the various valve production units within the Mullard organisation. Some of the glass parts for cathode ray tubes are also made here, and glass bulbs for the tubes are assembled in large quantities.

VALVE PRODUCTION

The strict control of quality, applied throughout the raw material stage, is continued in the manufacture of valve and cathode ray tube components—filaments, grids, anodes, mica discs, etc. With few exceptions,

Glass bulbs for miniature valves ready for transport to the assembly department.

The final inspection of gun assemblies for cathode ray tubes.

these parts are produced on intricate machines, designed and constructed in the company's own engineering department.

The highly skilled operations involved in assembling the components can only be carried out by hand. A high degree of mechanisation, however, is again employed in sealing the assemblies into their glass envelopes, and then exhausting these to a hard vacuum.

Careful inspections are made at every stage of manufacture and the finished products are subjected to rigorous production tests. Before the valves and cathode ray tubes are released for use, however, further intensive tests are carried out in specially-equipped technical departments.

The two main Mullard production units situated in Lancashire and Surrey, supported by five feeder factories, produce a major portion of the total output of valves and electron tubes made in the British Isles. Whilst radio valves and television picture tubes account for the greater part of the Mullard output, special tubes for industrial, medical, and research applications are also produced in vast quantities.

ALPHABETICAL INDEX TO VALVE DATA

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ME1200AA	171	49	PY80	124	42	UR3C	18	43
ME1201AA	172	50	PY81	185	42	UY1N	160	43
ME1202CA	173	50	PY82	124	43	UY11	161	43
ME1400	72	51	PZ30	17	43	UY21	85	43
ME1401	174	51	QP22B	35	39	UY41	14	43
ME1503	175	45	SP2	24	29	VP2	24	30
MF13–1	176	45	SP4	13, 27	30	VP2B	28	30
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MT57	178	46	SP13C	26	30	VP4B	26	30
MT105	179	46	TDD2A	10	36	VP13A	47	30
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MW31–16	116	45	TH21C	31	33	20AV	106	48
MW36–22	116	45	TH30C	31	33	20CG	107	48
MW41–1	116	45	UAF42	93	31	20CV	107	48
PENA4	25	38	UB41	92	34	52CG	125	48
PENB4	25	38	UBC41	97	36	55CG	126	48
PEN4DD	29	40	UBF11	141	31	57CV	182	48
PEN4VA	12, 25	39	UBF80	103	31	58CG	183	48
PEN36C	25	39	UBL1	157	40	58CV	183	48
PL33	70	39	UBL21	87	40	85A1	127	43
PL38	73	39	UCH11	144	33	85A2	128	43
PL81	122	39	UCH21	88	33	90AG	108	49
PL82	123	39	UCH42	94	33	90AV	108	49
PL83	105	39	UCL11	145	35/39	90CG	109	49
PM2A	3	35	UF9	158	30	90CV	109	49
PM2HL	3	35	UF11	146	30	150B2	186	43
PM12M	4	29	UF21	86	30	354V	9	35
PM22A	11	39	UF41	96	30	1267	184	46
PM22D	11	39	UF42	95	30	4687	49	43
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PY31	53	42	UR1C	6	43			

VALVE APPLICATION INDEX OF PREFERRED TYPES

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VOLTAGE AMPLIFYING PENTODES				
DF66	0·625	0·015	Hearing-aid pentode.	28
DF91	1·4	0·05	Variable-mu R.F. pentode.	28
DF92	1·4	0·05	Short grid base R.F. pentode.	28
EF37A	6·3	0·2	Low microphony, low hum A.F. pentode.	29
EF40	6·3	0·2	Low noise A.F. pentode.	29
EF41	6·3	0·2	Variable-mu R.F. pentode.	29
EF80	6·3	0·3	High slope R.F. pentode.	29
EF95	6·3	0·175	High slope R.F. pentode.	29
UF41	12·6	0·1	Variable-mu R.F. pentode.	30
VOLTAGE AMPLIFYING PENTODES WITH DIODES				
DAF91	1·4	0·05	Short grid base A.F. pentode with single diode.	31
EBF80	6·3	0·3	Variable-mu R.F. pentode with double diode.	31
UBF80	17	0·1	Variable-mu R.F. pentode with double diode.	31
FREQUENCY CHANGERS				
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ECH42	6·3	0·23	Triode hexode.	32
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SINGLE AND DOUBLE DIODES				
DA90	1·4	0·15	Indirectly heated single diode.	33
EB91	6·3	0·3	Double diode with separate cathodes.	34
TRIODES AND DOUBLE TRIODES				
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ECC33	6·3	0·4	A.F. double triode with separate cathodes.	34
ECC35	6·3	0·4	A.F. double triode with separate cathodes.	35
ECC40	6·3	0·6	A.F. double triode with separate cathodes.	35
ECC81	6·3 12·6	0·3 0·15	R.F. double triode with separate cathodes.	35
ECC91	6·3	0·45	R.F. double triode with common cathode.	35
ECL80	6·3	0·3	Triode combined with output pentode.	35
TRIODES WITH DIODES				
EBC41	6·3	0·23	Double diode triode.	36
UBC41	14	0·1	Double diode triode.	36

VALVE APPLICATION INDEX OF PREFERRED TYPES

VALVE APPLICATION INDEX OF PREFERRED TYPES

TYPE	DESCRIPTION				PAGE
VOLTAGE REFERENCE AND STABILIZING TUBES					
85A1	85-volt Voltage reference tube.				43
85A2	85-volt Voltage reference tube.				43
150B2	150-volt Voltage stabilizer.				43
CATHODE RAY TUBES					
DB4-1	$1\frac{3}{4}$ in.	Oscilloscope.	Blue screen.	Symmetrical.	44
DB4-2	$1\frac{3}{4}$ in.	Oscilloscope.	Blue screen.	Asymmetrical.	44
DB7-5	$2\frac{3}{4}$ in.	Oscilloscope.	Blue screen.	Symmetrical.	44
DB7-6	$2\frac{3}{4}$ in.	Oscilloscope.	Blue screen.	Asymmetrical.	44
DB13-2	5 in.	Oscilloscope.	Blue screen.	Symmetrical.	44
DG4-1	$1\frac{3}{4}$ in.	Oscilloscope.	Green screen.	Symmetrical.	44
DG4-2	$1\frac{3}{4}$ in.	Oscilloscope.	Green screen.	Asymmetrical.	44
DG7-5	$2\frac{3}{4}$ in.	Oscilloscope.	Green screen.	Symmetrical.	44
DG7-6	$2\frac{3}{4}$ in.	Oscilloscope.	Green screen.	Asymmetrical.	44
DG13-2	5 in.	Oscilloscope.	Green screen.	Symmetrical.	44
DP4-1	$1\frac{3}{4}$ in.	Oscilloscope.	Long afterglow.	Symmetrical.	44
DP4-2	$1\frac{3}{4}$ in.	Oscilloscope.	Long afterglow.	Asymmetrical.	44
DP13-2	5 in.	Oscilloscope.	Long afterglow.	Symmetrical.	44
DR7-5	$2\frac{3}{4}$ in.	Oscilloscope.	Long afterglow.	Symmetrical.	44
DR7-6	$2\frac{3}{4}$ in.	Oscilloscope.	Long afterglow.	Asymmetrical.	44
MF13-1	5 in.	Radar.	Orange screen.	Magnetic.	45
MF31-22	12 in.	Radar.	Orange screen.	Magnetic.	45
MW6-2	$2\frac{1}{2}$ in.	Projection television.		Metal-backed.	45
MW31-16	12 in.	Television.		Ion-trap.	45
MW36-22	14 in.	Television.	Rectangular.	Ion-trap.	45
MW41-1	16 in.	Television.	Metal cone.	Ion-trap.	45
FLASH-TUBES					
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LSD3	100 joule Photographic flash-tube.				46
LSD5	1,000 joule Photographic flash-tube.				47
LSD7	200 joule Photographic flash-tube.				47
LSD8	Stroboscopic tube. 30 W mean dissipation.				47
PHOTOCELLS					
20CG	Gas-filled. Incandescent light and infra-red radiation.				48
20CV	Vacuum. Incandescent light and infra-red radiation.				48
52CG	Gas-filled. Incandescent light and infra-red radiation.				48
55CG	Gas-filled. Incandescent light and infra-red radiation.				48
57CV	Photometric cell.				48
58CG	End-on wire-in. Gas-filled. Incandescent light and infra-red radiation.				48
58CV	End-on wire-in. Vacuum. Incandescent light and infra-red radiation.				48
90AG	Gas-filled. Daylight and blue radiation.				49
90AV	Vacuum. Daylight and blue radiation.				49
90CG	Gas-filled. Incandescent light and infra-red radiation.				49
90CV	Vacuum. Incandescent light and infra-red radiation.				49

VALVE APPLICATION INDEX OF PREFERRED TYPES

TYPE	DESCRIPTION	PAGE
U.H.F. TUBES		
ME1001	Disc seal triode oscillator.	50
ME1005	Disc seal triode voltage amplifier.	50
ME1100	3 cm. local oscillator reflex klystron.	51
ME1101	3 cm. fixed frequency packaged magnetron.	51
IMAGE CONVERTER TUBES		
ME1200AA	Image converter. Daylight and blue radiation.	49
ME1201AA	Grid-controlled image converter. Daylight and blue radiation.	50
ME1202CA	Small image-converter. Infra-red radiation.	50
	Variants of these tubes with different photocathodes and luminescent screens are also available.	
ACCELEROMETER TUBE		
DDR100	Accelerometer double diode.	51
ELECTROMETER VALVES		
ME1400	Electrometer pentode.	51
ME1401	Subminiature electrometer triode.	51

REFERENCES

a Anode. C.R.T. anodes marked a1, a2, etc., a1 being nearest the cathode.
g Grid. Grids marked g1, g2, etc., g1 being nearest the cathode.
k Cathode.
f Filament.
h Heater.
s Internal shield.
M External metallising.
T Trigger electrode (Flash-tubes).
IC Internal connection; not to be used for external connections.
Va Anode voltage.
Vg2 Screen grid voltage.
Vg1 Control grid voltage.

Not applicable to frequency changers with additional oscillator electrodes. (applies to Va, Vg2, Vg1)

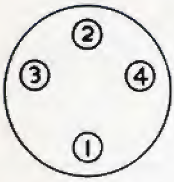
Vf Filament voltage.
Vh Heater voltage.
va(pk) Peak anode voltage.
P.I.V. Peak inverse voltage.
Ia Anode current.
Ig2 Screen grid current.
If Filament current.
Ih Heater current.
It Target current.
Iout Output current.
ia(pk) Peak anode current.
Pout Output power.
pa Anode dissipation.
Ra External anode load.
Rk Cathode bias resistor.
ra Internal anode impedance.
μ Amplification factor.
gm Mutual conductance.
gc Conversion conductance.
S Sensitivity (cathode ray tubes).

BASE REFERENCES

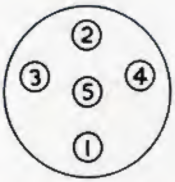
A British 4-pin.
K International octal.
M British 7-pin.
MO Mazda octal.
O British 5-pin.
P Side contact (8-contact).
UX American base.
V Side contact (5-contact).
Y European 8-pin.
B2A 2 wire-in leads.
B3A American Pee-wee 3-pin.
B3G 3-pin all-glass.
B4D Super Jumbo 4-pin.
B5A Flat subminiature.
B7G 7-pin miniature.
B8A 8-pin miniature.
B8D 10 mm. round subminiature.
B8G Loctal.
B9A 9-pin miniature (noval).
B9G 9-pin all-glass.
B12A Duodecal.
B14A Diheptal.

VALVE BASE DIAGRAMS

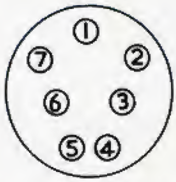
viewed from free end of pins



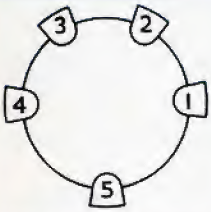
British 4-pin (A Base)



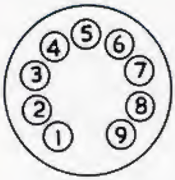
British 5-pin (O Base)



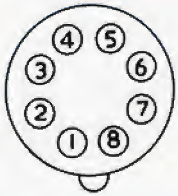
British 7-pin (M Base)



Side Contact (V Base)

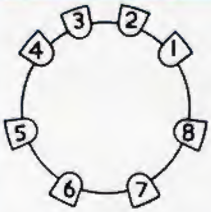


Noval (B9A)



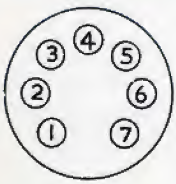
8-pin Miniature (B8A)

Duodecal (B12A)

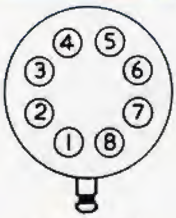


Side Contact (P Base)

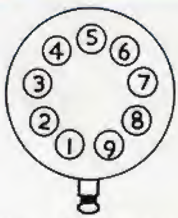
Octal (K Base)



7-pin Miniature (B7G)

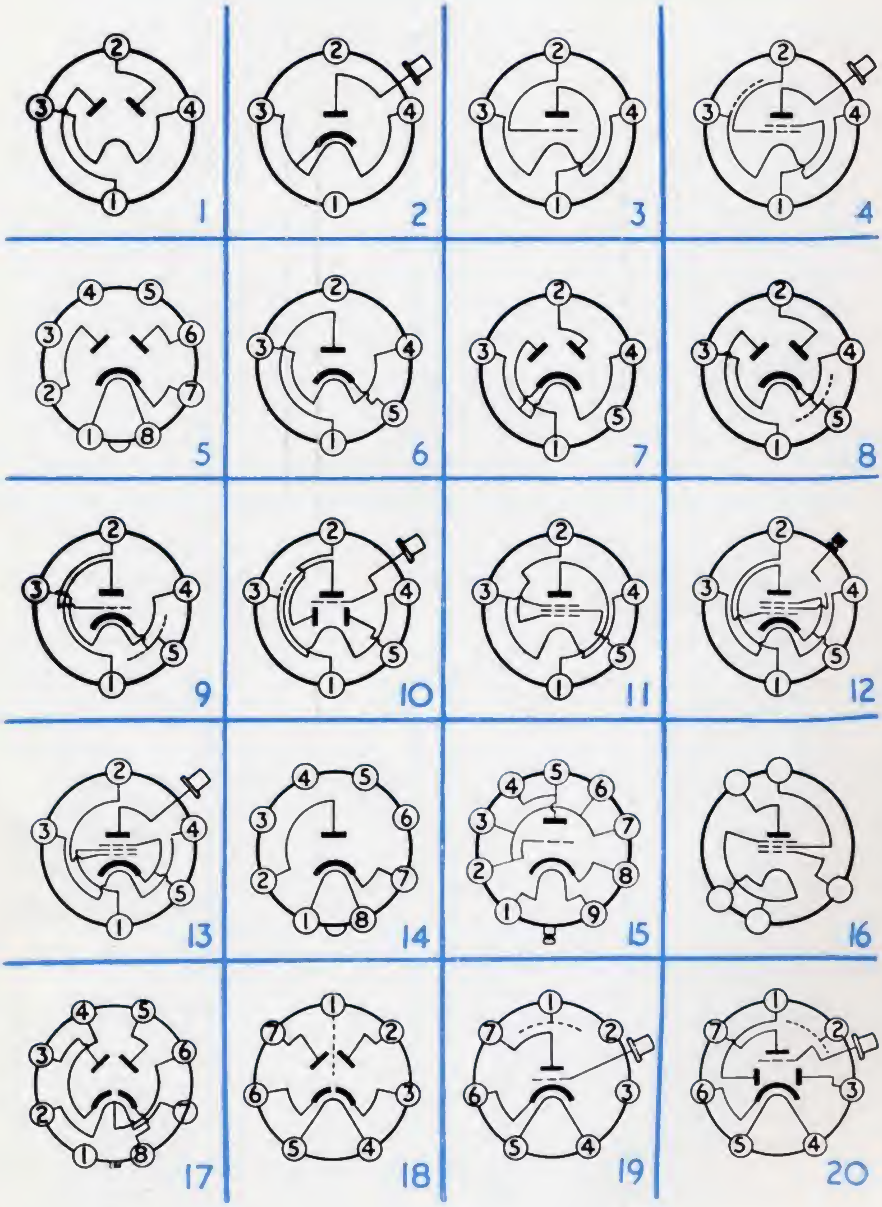


Loctal (B8G)



9-pin All glass (B9G)

VALVE BASE DIAGRAMS



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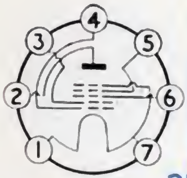
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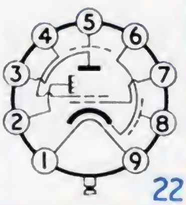
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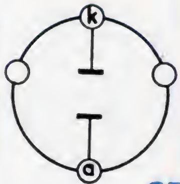
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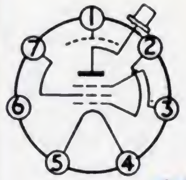
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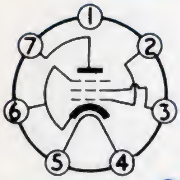
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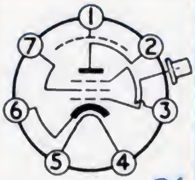
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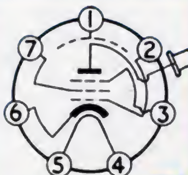
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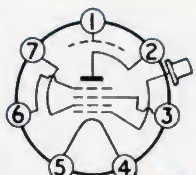
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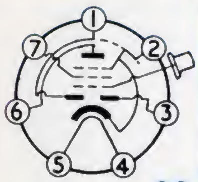
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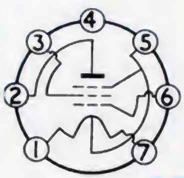
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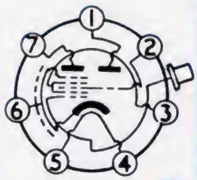
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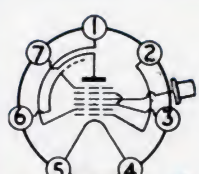
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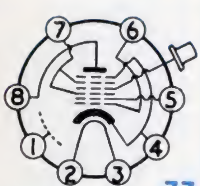
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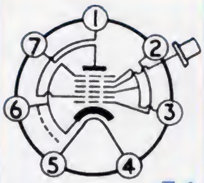
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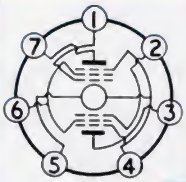
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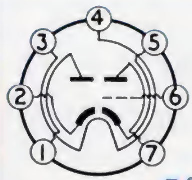
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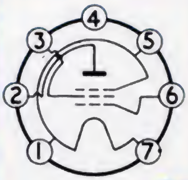
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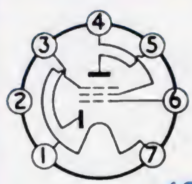
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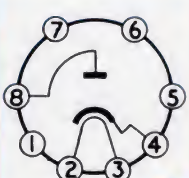
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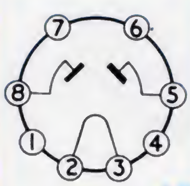
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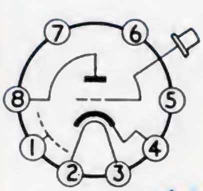
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VALVE BASE DIAGRAMS


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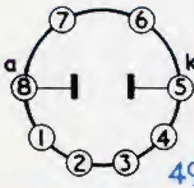

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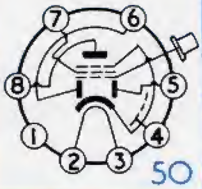
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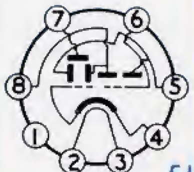
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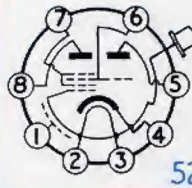
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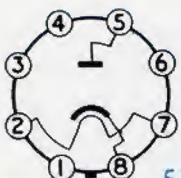
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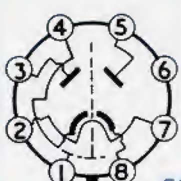
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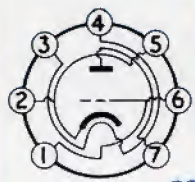
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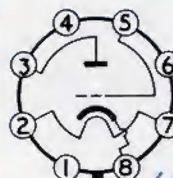
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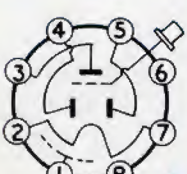
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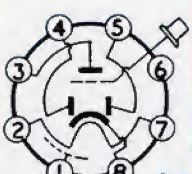
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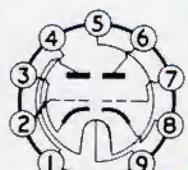
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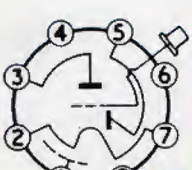
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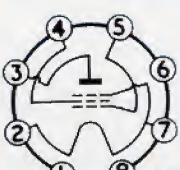
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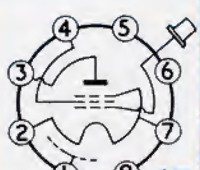
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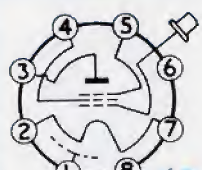
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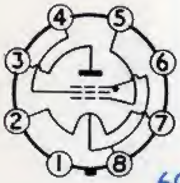
VALVE BASE DIAGRAMS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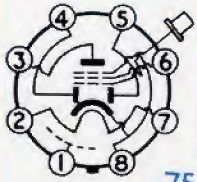
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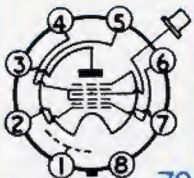
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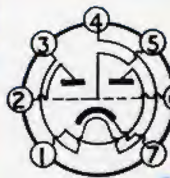
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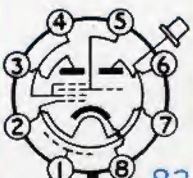
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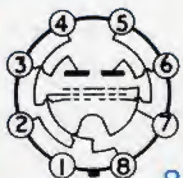
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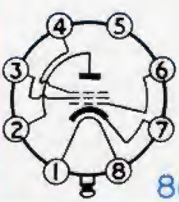
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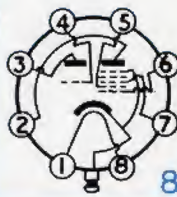
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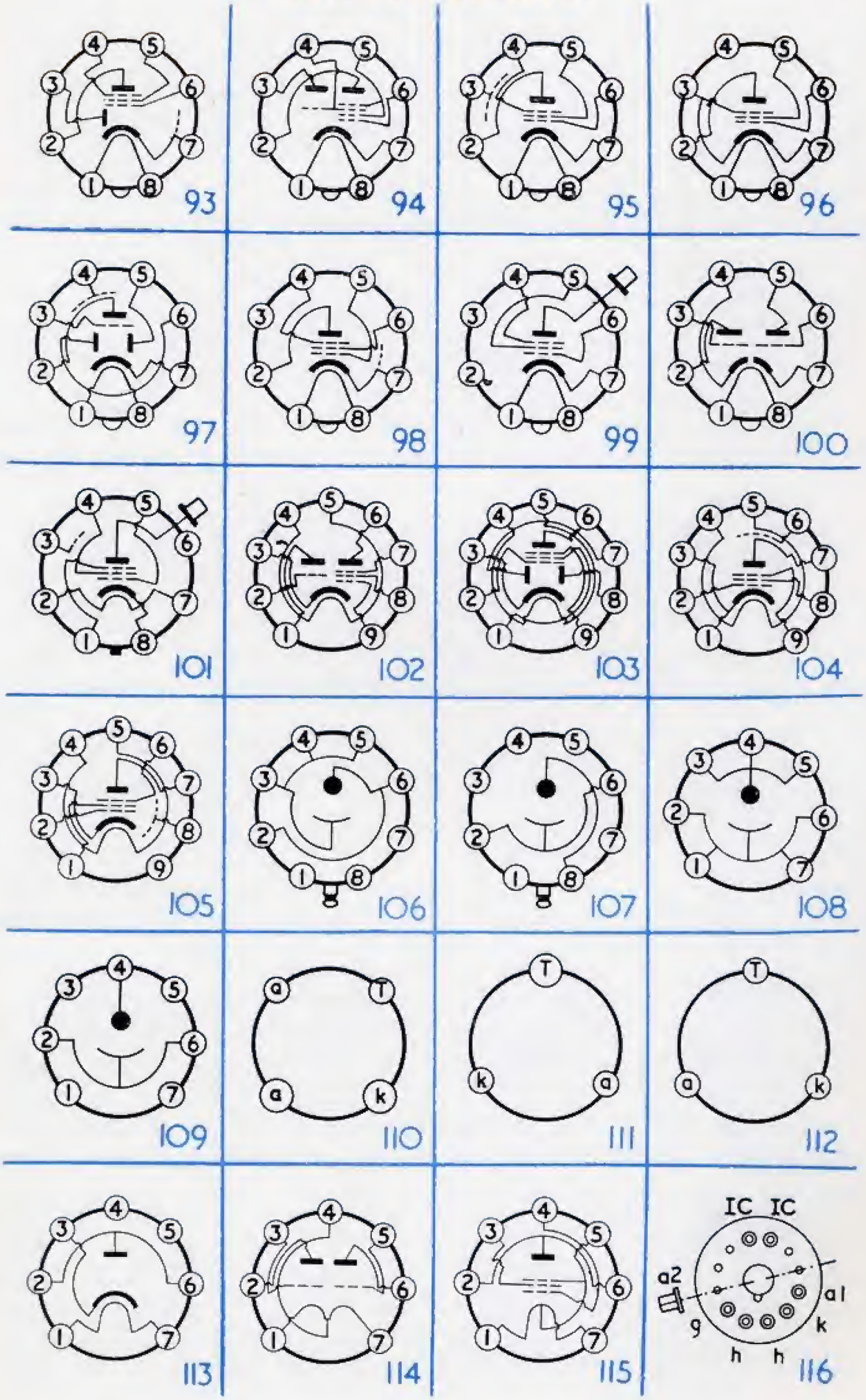
VALVE BASE DIAGRAMS



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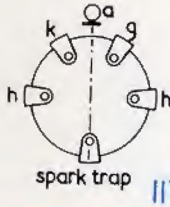

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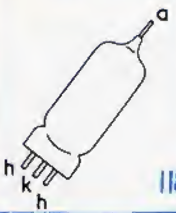

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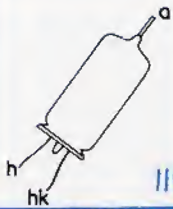

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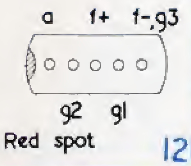

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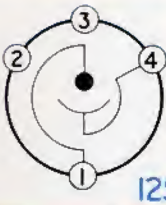
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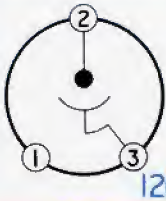
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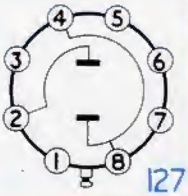
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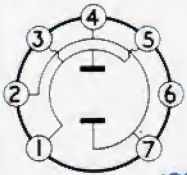
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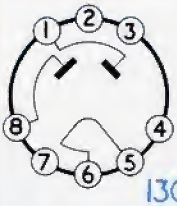
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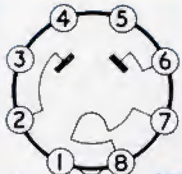
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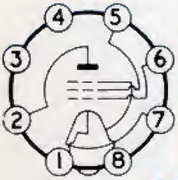
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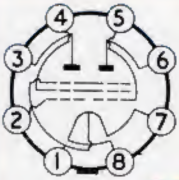
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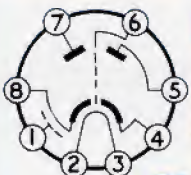
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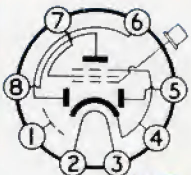
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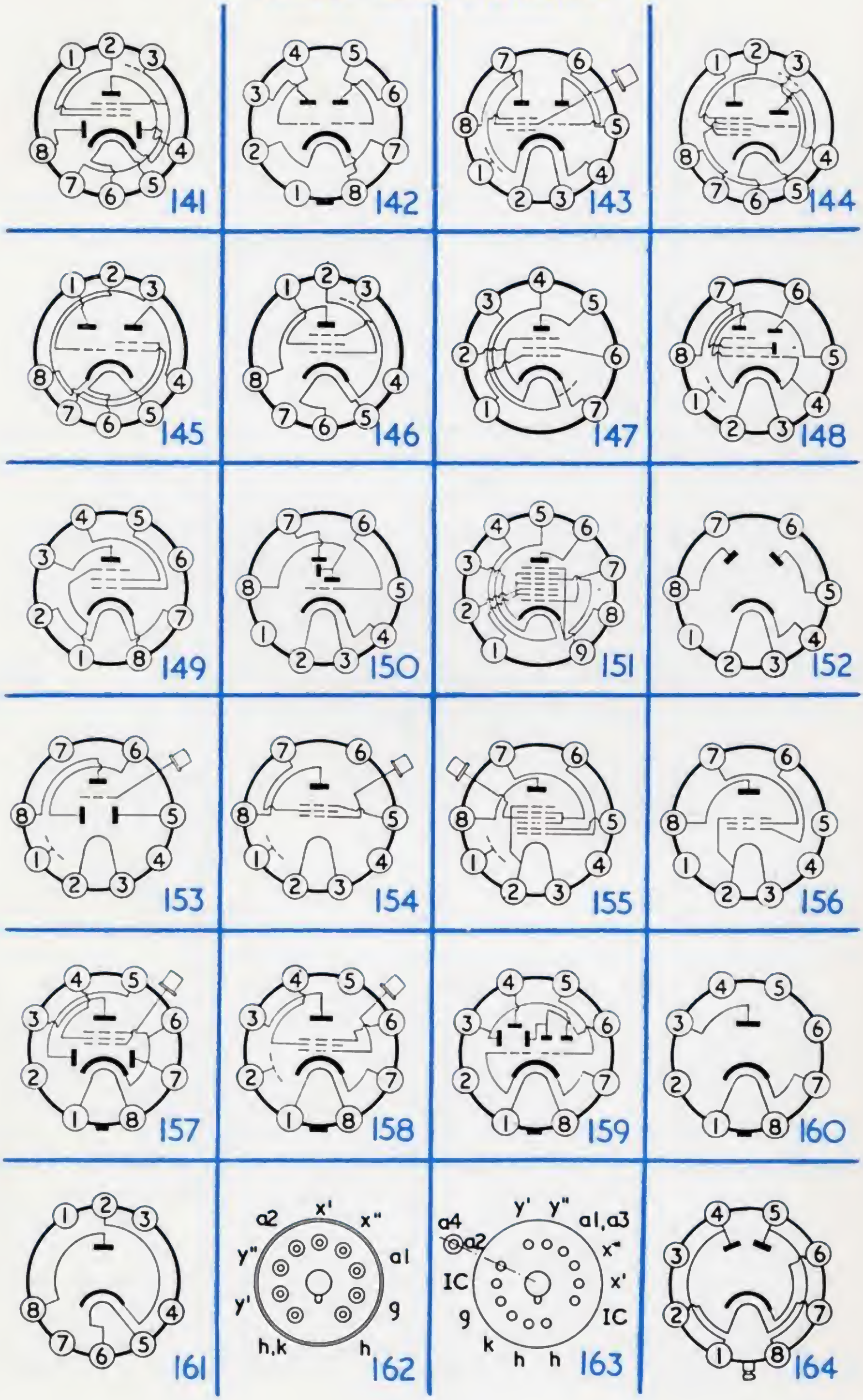
VALVE BASE DIAGRAMS



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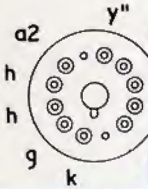

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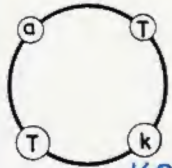

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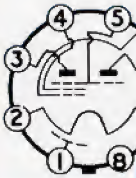

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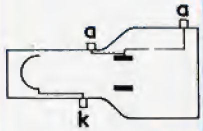

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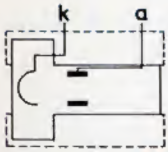

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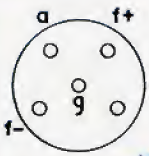

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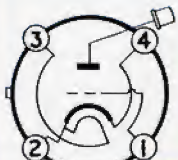

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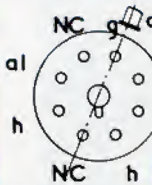

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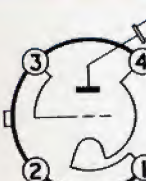

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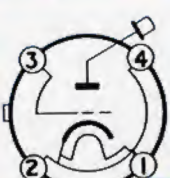

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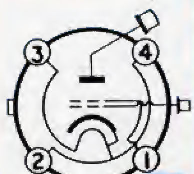

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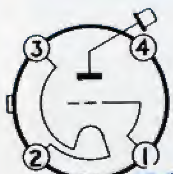

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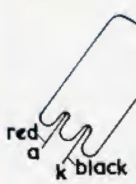

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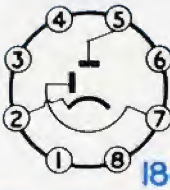

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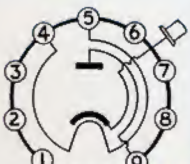

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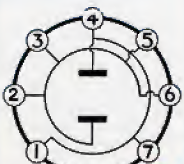

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These diagrams are referred to in the Alphabetical Index and the Base column of the Valve Data section.

VALVE DATA

VOLTAGE AMPLIFYING PENTODES

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va (V)	Vg2 (V)	—Vg1 (V)	Ia (mA)	Ig2 (mA)	gm (mA/V)	ra (MΩ)
AF3	Variable-mu R.F. Pentode	P. (47)	4·0	0·65	250	100	3·0	8·0	2·6	1·8	1·2
AF7	Short Grid Base R.F. Pentode	P. (47)	4·0	0·65	250	100	2·0	3·0	1·1	2·1	2·0
DF21	Short Grid Base R.F. or A.F. Pentode	Octal (133)	1·4	0·025	90	90	0	1·2	0·25	0·7	2·0
DF22	Variable-mu R.F. Pentode	Octal (133)	1·4	0·05	90	90	1·5	1·4	0·3	1·1	1·5
DF33	Variable-mu R.F. Pentode	Octal (67)	1·4	0·05	90	90	0	1·2	0·3	0·75	1·5
DF66	**Hearing-aid Pentode .. ..**	**B5A (121)**	**0·625**	**0·015**	**22·5**	**22·5**	**1·05**	**0·05**	**0·015**	**0·1**	**2·0**
DF70	Hearing-aid Pentode	B8D (16)	0·625	0·025	30	30	0	0·375	0·125	0·22	0·5
DF91	**Variable-mu R.F. Pentode .. .. ..**	**B7G (38)**	**1·4**	**0·05**	**90**	**67·5**	**0 17**	**3·5 —**	**1·4 —**	**0·9 0·009**	**0·5 —**
DF92	**Short Grid Base R.F. Pentode .. ..**	**B7G (38)**	**1·4**	**0·05**	**90**	**67·5**	**0**	**3·7**	**1·4**	**1·0**	**0·5**
ECF1	Variable-mu R.F. Pentode combined with Triode (for Triode data see p. 35)	P. (143)	6·3	0·2	250	100	2·0	5·0	2·0	2·0	1·6
EF9	Variable-mu R.F. Pentode	P. (47)	6·3	0·2	250	Rg2= 90 K Ω	2·5	6·0	1·7	2·2	1·25
EF11	Variable-mu R.F. Pentode	Y. (146)	6·3	0·2	250	Rg2= 75 K Ω	2·0	6·0	2·0	2·2	2·0
EF12	Short Grid Base R.F. Pentode	Y. (146)	6·3	0·2	250	100	2·0	3·0	1·0	2·1	2·0
EF22	Variable-mu R.F. Pentode	B8G (86)	6·3	0·2	250	Rg2= 90 K Ω	2·5	6·0	1·7	2·2	1·2

VOLTAGE AMPLIFYING PENTODES—*continued*

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va (V)	Vg2 (V)	—Vg1 (V)	Ia (mA)	Ig2 (mA)	gm (mA/V)	ra (MΩ)
EF36	Short Grid Base R.F. or A.F. Pentode	Octal (72)	6·3	0·2	250	100	2·0	3·0	0·8	1·8	2·5
EF37	Low Microphony A.F. Pentode	Octal (72)	6·3	0·2	250	100	2·0	3·0	0·8	1·8	2·5
EF37A	**Low Microphony, Low Hum A.F. Pentode**	**Octal (72)**	**6·3**	**0·2**	**250**	**100**	**2·0**	**3·0**	**0·8**	**1·8**	**2·5**
EF39	Variable-mu R.F. Pentode	Octal (72)	6·3	0·2	250	Rg2= 90 KΩ	2·5 39	6·0 —	1·7 —	2·2 0·022	1·25 >10
EF40	**Low Noise A.F. Pentode .. .. ..**	**B8A (98)**	**6·3**	**0·2**	**250**	**140**	**2·0**	**3·0**	**0·55**	**1·85**	**2·5**
EF41	**Variable-mu R.F. Pentode .. .. ..**	**B8A (96)**	**6·3**	**0·2**	**250**	**Rg2= 90 KΩ**	**2·5 39**	**6·0 —**	**1·7 —**	**2·2 0·022**	**1·0 >10**
EF42	High Slope R.F. Pentode	B8A (95)	6·3	0·33	250	250	2·0	10	2·3	9·5	0·44
EF50	High Slope R.F. Pentode	B9G (90)	6·3	0·3	250	250	2·0	10	3·0	6·5	1·0
EF54	High Slope R.F. Pentode	B9G (91)	6·3	0·3	250	250	1·7	10	1·45	7·7	0·5
EF55	High Slope R.F. Pentode for use in Video Amplifiers	B9G (90)	6·3	1·0	250	250	4·5	40	5·5	12	0·055
EF80	**High Slope R.F. Pentode .. .. ..**	**B9A (104)**	**6·3**	**0·3**	**170**	**170**	**2·0**	**10**	**2·5**	**7·4**	**0·4**
EF91	High Slope R.F. Pentode	B7G (74)	6·3	0·3	250	250	2·0	10	2·5	7·6	1·0
EF92	Variable-mu R.F. Pentode	B7G (74)	6·3	0·2	250	200	2·5	8·0	2·1	2·5	0·5
EF95	**High Slope R.F. Pentode .. .. ..**	**B7G (147)**	**6·3**	**0·175**	**180**	**120**	**2·0**	**7·7**	**2·4**	**5·1**	**0·69**
KF3	Variable-mu R.F. Pentode	P. (154)	2·0	0·045	135	135	0·5	2·0	0·6	0·65	1·3
KF35	Variable-mu R.F. Pentode	Octal (68)	2·0	0·05	120	60	1·5	1·45	0·5	1·0	—
PM12M	Variable-mu R.F. Tetrode	British 4-pin (4)	2·0	0·18	150	90	0	2·5	0·5	1·4	—
SP2	Short Grid Base R.F. Pentode	British 7-pin (24)	2·0	0·18	135	135	0	3·0	1·0	1·8	0·7

VOLTAGE AMPLIFYING PENTODES—*continued*

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va (V)	Vg2 (V)	−Vg1 (V)	Ia (mA)	Ig2 (mA)	gm (mA/V)	ra (MΩ)
SP4	Short Grid Base R.F. Pentode	British 5- or 7-pin (13 or 27)	4·0	1·0	200	100	2·0	3·0	1·1	2·3	2·2
SP4B	Sharp Cut-off R.F. Pentode	British 7-pin (26)	4·0	0·65	250	250	2·4	4·0	1·5	3·4	2·0
SP13	Sharp Cut-off R.F. Pentode	P. (47)	13	0·2	200	100	2·0	3·3	1·2	2·2	1·3
SP13C	Sharp Cut-off R.F. Pentode	British 7-pin (26)	13	0·2	200	200	2·2	2·5	0·9	2·8	2·5
UF9	Variable-mu R.F. Pentode	Octal (158)	12·6	0·1	200	Rg2= 60 KΩ	2·5	6·0	1·7	2·2	1·2
UF11	Variable-mu R.F. Pentode	Y. (146)	15	0·1	200	Rg2= 70 KΩ	2·0	6·0	1·7	2·2	1·5
UF21	Variable-mu R.F. Pentode	B8G (86)	12·6	0·1	200	Rg2= 60 KΩ	2·5	6·0	1·7	2·2	1·0
UF41	**Variable-mu R.F. Pentode**	**B8A** (96)	**12·6**	**0·1**	**170**	**Rg2= 39 KΩ**	**2·5** **28**	**6·0** —	**1·75** —	**2·2** **0·022**	**1·0** **>10**
UF42	High Slope R.F. Pentode	B8A (95)	21	0·1	170	170	2·0	10	2·8	8·5	0·2
VP2	Variable-mu R.F. Pentode	British 7-pin (24)	2·0	0·18	135	135	0	3·0	1·25	1·5	0·4
VP2B	Variable-mu R.F. Hexode	British 7-pin (28)	2·0	0·135	135	60*	1·5	2·0	0·95	1·4	1·3
VP4	Variable-mu R.F. Pentode	British 5- or 7-pin (13 or 27)	4·0	1·0	200	100	2·0	4·5	1·9	2·3	1·0
VP4A	Variable-mu R.F. Pentode	British 5- or 7-pin (13 or 27)	4·0	1·2	200	100	2·0	4·25	1·8	2·5	1·4
VP4B	Variable-mu R.F. Pentode	British 7-pin (26)	4·0	0·65	250	250	3·0	11·5	4·25	2·0	—
VP13A	Variable-mu R.F. Pentode	P. (47)	13	0·2	200	100	2·0	4·0	1·4	2·2	—
VP13C	Variable-mu R.F. Pentode	British 7-pin (26)	13	0·2	200	200	2·0	9·0	3·6	2·2	—

* Vg3 = Vg2, Vg4 = 0

VOLTAGE AMPLIFYING PENTODES WITH DIODE(S)

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va (V)	Vg2 (V)	−Vg1 (V)	Ia (mA)	Ig2 (mA)	gm (mA/V)	ra (MΩ)
DAF91	**Short Grid Base A.F. Pentode with Single Diode**	**B7G (40)**	**1·4**	**0·05**	**90**	**90**	**0**	**2·7**	**0·5**	**0·72**	**0·5**
EAF42	Variable-mu R.F. Pentode with Single Diode	B8A (93)	6·3	0·2	250	Rg2= 110 KΩ	2·0 43	5·0 —	1·5 —	2·0 0·02	1·4 —
EBF2	Variable-mu R.F. Pentode with Double Diode	P. (140)	6·3	0·2	250	Rg2= 95 KΩ	2·0	5·0	1·6	1·8	1·3
EBF11	Variable-mu R.F. Pentode with Double Diode	Y. (141)	6·3	0·2	250	Rg2= 85 KΩ	2·0	5·0	1·8	1·8	2·0
EBF32	Variable-mu R.F. Pentode with Double Diode	Octal (75)	6·3	0·2	250	Rg2= 95 KΩ	2·0	5·0	1·6	1·8	1·3
EBF80	**Variable-mu R.F. Pentode with Double Diode**	**B9A (103)**	**6·3**	**0·3**	**250**	**Rg2= 95 KΩ**	**2·0** **41·5**	**5·0** —	**1·75** —	**2·2** **0·022**	**1·5** **>10**
UAF42	Variable-mu R.F. Pentode with Single Diode	B8A (93)	12·6	0·1	170	Rg2= 56 KΩ	2·0 28	5·0 —	1·5 —	2·0 0·02	0·9 >10
UBF11	Variable-mu R.F. Pentode with Double Diode	Y. (141)	20	0·1	200	Rg2= 70 KΩ	2·0	5·0	1·7	1·8	1·5
UBF80	**Variable-mu R.F. Pentode with Double Diode**	**B9A (103)**	**17**	**0·1**	**170**	**Rg2= 47 KΩ**	**2·0** **26·5**	**5·0** —	**1·75** —	**2·2** **0·022**	**0·9** **>10**

FREQUENCY CHANGERS

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va (V)	Vg2+4 (V)	−Vg1 (V)	Ia (mA)	Ig2+4 (mA)	gc (mA/V)	ra (KΩ)
AK2	Octode	P. (33)	4·0	0·65	250	70 (Vg3+5)	1·5 (Vg4)	1·6	3·8 (Ig3+5)	0·6	1,600
CCH35	Triode Hexode	Octal (82)	7·0	0·2	● 200 △ 100	100 —	2·0 0	3·0 10	3·0 —	0·65 —	900 8·6
DK21	Octode	Octal (134)	1·4	0·05	120	Rg5= 120 KΩ	0 (Vg4)	1·5	0·25 (Ig5)	0·5	500
DK32	Heptode	Octal (77)	1·4	0·05	90	45 (Vg3+5)	0 (Vg4)	0·6	0·7 (Ig3+5)	0·25	600

● Mixer Section. △ Triode Section.

FREQUENCY CHANGERS—*continued*

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va (V)	Vg2+4 (V)	−Vg1 (V)	Ia (mA)	Ig2+4 (mA)	gc (mA/V)	ra (KΩ)
DK40	Octode	B8A (135)	1·4	0·05	135	Rg5= 270 KΩ	0 (Vg4)	1·0	0·25 (Ig5)	0·425	1,000
DK91	Heptode	B7G (41)	1·4	0·05	90	67·5	0 (Vg3)	1·6	3·2	0·3	600
DK92	**Heptode**	**B7G (21)**	**1·4**	**0·05**	**90**	**60 (Vg4)**	**0 (Vg3)**	**0·7**	**0·15 (Ig4)**	**0·325**	**650**
ECH3	Triode Hexode	P. (52)	6·3	0·2	● 250 △ 100	100 —	2·0 0	3·0 10	3·0 —	0·65 —	1,300 8·6
ECH11	Triode Hexode	Y. (144)	6·3	0·2	● 250 △ 150	100 —	2·0 0	2·3 15·5	3·0 —	0·65 —	1,200 6·0
ECH21	Triode Heptode	B8G (88)	6·3	0·33	● 250 △ 100	100 —	2·0 0	3·0 12	6·2 —	0·75 —	1·4 6·5
ECH33	Triode Hexode	Octal (82)	6·3	0·2	● 250 △ 100	100 —	2·0 0	3·0 10	3·0 —	0·65 —	1,300 8·6
ECH35	Triode Hexode	Octal (82)	6·3	0·3	● 250 △ 100	100 —	2·0 0	3·0 10	3·0 —	0·65 —	1,300 8·6
ECH42	**Triode Hexode**	**B8A (94)**	**6·3**	**0·23**	**● 250 △ 100**	**85 —**	**2·0 0**	**3·0 10**	**3·0 —**	**0·75 —**	**1,000 8·0**
EK2	Octode	P. (33)	6·3	0·2	250	50 (Vg3+5)	2 (Vg4)	1·0	0·8 (Ig3+5)	0·55	2,000
EK32	Octode	Octal (81)	6·3	0·2	250	50 (Vg3+5)	2 (Vg4)	1·0	0·8 (Ig3+5)	0·55	2,000
FC2A	Octode	British 7-pin (32)	2·0	0·13	135	45 (Vg3+5)	0·5 (Vg4)	0·7	0·7 (Ig3+5)	0·27	2,500
FC4	Octode	British 7-pin (34)	4·0	0·65	250	70 (Vg3+5)	1·5 (Vg4)	1·6	3·8 (Ig3+5)	0·6	—
FC13	Octode	P. (33)	13	0·2	200	70 (Vg3+5)	1·5 (Vg4)	1·6	3·8 (Ig3+5)	0·6	—
FC13C	Octode	British 7-pin (34)	13	0·2	200	70 (Vg3+5)	1·5 (Vg4)	1·6	3·8 (Ig3+5)	0·6	—
KCF30	Triode Pentode	Octal (170)	2·0	0·2	● 120 △ 100	60 (Vg2) —	1·5 0	0·53 5·5	1·0 (Ig2) —	0·26 —	— 10·5

● Mixer Section. △ Triode Section.

FREQUENCY CHANGERS—*continued*

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va (V)	Vg2+4 (V)	−Vg1 (V)	Ia (mA)	Ig2+4 (mA)	gc (mA/V)	ra (KΩ)
KK2	Octode	P. (155)	2·0	0·13	135	45 (Vg3+5)	0·5 (Vg4)	0·7	0·7 (Ig3+5)	0·27	2,500
KK32	Octode	Octal (79)	2·0	0·13	135	45 (Vg3+5)	0·5 (Vg4)	0·7	0·7 (Ig3+5)	0·27	—
TH4B	Triode Heptode	British 7-pin (31)	4·0	1·45	● 250 △ 100	100 —	2·5 0	3·25 9·5	6·0 —	0·75 —	1,500 —
TH21C	Triode Hexode	British 7-pin (31)	21	0·2	● 250 △ 125	70 —	1·5 0	1·6 6·0	3·8 —	0·6 —	— —
TH30C	Triode Heptode	British 7-pin (31)	29	0·2	● 250 △ 100	100 —	2·5 0	3·25 9·5	6·0 —	0·75 —	1,500 —
UCH11	Triode Hexode	Y. (144)	20	0·1	● 200 △ 150	80 —	2·0 0	2·5 19	3·0 —	0·75 —	1,000 —
UCH21	Triode Heptode	B8G (88)	20	0·1	● 200 △ 100	100 —	2·0 0	3·5 12	6·5 —	0·75 —	1,000 —
UCH42	**Triode Hexode**	**B8A (94)**	**14**	**0·1**	● **170** △ **100**	**70** —	**1·85** **0**	**2·1** **10**	**2·6** —	**0·67** —	**1,000** **8·0**

● Mixer Section. △ Triode Section.

DIODES

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va max. (V)	Ia max. (mA)
AB2	Double Diode	V. (129)	4·0	0·65	200	0·8
DA90	**Indirectly-heated Single Diode**	**B7G (113)**	**1·4**	**0·15**	**330** **(P.I.V. max.)**	**0·5**
EA50	Single Diode	B3G (118)	6·3	0·15	50	5·0
EB4	Double Diode with separate Cathodes	P. (139)	6·3	0·2	200	0·8
EB34	Double Diode with separate Cathodes	Octal (58)	6·3	0·2	200	0·8
EB41	Double Diode with separate Cathodes	B8A (92)	6·3	0·3	150	9·0

DIODES—*continued*

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va max. (V)	Ia max. (mA)
EB91	**Double Diode with separate Cathodes**	**B7G (37)**	**6·3**	**0·3**	**420 (P.I.V. max.)**	**9·0**
KB2	Double Diode	V. (129)	2·0	0·095	125	0·5
UB41	Double Diode with separate Cathodes	B8A (92)	19	0·1	150	9·0
2D4A	Double Diode	British 5-pin (8)	4·0	0·65	200	0·8

TRIODES AND DOUBLE TRIODES

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va (V)	—Vg (V)	Ia (mA)	μ	gm (mA/V)	ra (KΩ)
ACO44	Directly-heated Output Triode	British 4-pin (3)	4·0	1·0	300	38	50	6·0	5·0	1·2
DCC90	**R.F. Double Triode suitable for portable transmitters**	**B7G (114)**	**1·4 / 2·8**	**0·22 / 0·11**	**90**	**2·5**	**3·7**	**15**	**1·8**	**8·3**
EC31	Low Impedance Triode	Octal (60)	6·3	0·65	250	16	20	10·5	3·2	3·3
EC52	Low power V.H.F. Oscillator Triode	B9G (89)	6·3	0·43	250	2·6	10	60	6·5	9·2
EC53	Low power U.H.F. Oscillator Triode	B3G (120)	6·3	0·25	200	3·3	7·5	33	4·0	11·4
EC54	Earthed Grid Triode	B9G (15)	6·3	0·43	250	1·5	10	98	9·0	11·1
EC91	Earthed Grid Triode	B7G (59)	6·3	0·3	250	1·5	10	100	8·5	12
ECC31	Medium Impedance Double Triode	Octal (142)	6·3	0·95	250	4·6	6·0	32	2·3	14
ECC32	Medium Impedance Double Triode with separate Cathodes	Octal (64)	6·3	0·95	250	4·6	6·0	32	2·3	14
ECC33	**High Slope, Low Impedance Double Triode with separate Cathodes**	Octal (64)	**6·3**	**0·4**	**250**	**4·0**	**9**	**35**	**3·6**	**9·7**
ECC34	Low Impedance Double Triode with separate Cathodes	Octal (64)	6·3	0·95	250	16	10	11·5	2·2	5·2

TRIODES AND DOUBLE TRIODES—*continued*

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va (V)	−Vg (V)	Ia (mA)	μ	gm (mA/V)	ra (KΩ)
ECC35	**High-gain Double Triode with separate Cathodes**	Octal (64)	6·3	0·4	250	2·5	2·3	68	2·0	34
ECC40	**Low Microphony Double Triode with separate Cathodes**	B8A (100)	6·3	0·6	250	5·2	6·0	30	2·7	11
ECC81	**Double Triode with separate Cathodes for use as Frequency Changer or R.F. Amplifier**	B9A (63)	6·3 12·6	0·3 0·15	170	1·5	7·0	57	4·8	12
ECC91	**Double Triode for use as a R.F. Amplifier or Oscillator**	B7G (80)	6·3	0·45	100	0·85	8·5	38	5·3	7·1
ECF1	Triode combined with R.F. or I.F. Pentode (for Pentode data see page 28)	P. (143)	6·3	0·2	150	3·0	8·0	20	2·2	9·0
ECL11	Triode combined with an Output Tetrode (for Tetrode data see page 37)	Y. (145)	6·3	1·0	250	2·5	2·0	70	2·0	35
ECL80	**Triode combined with an Output Pentode (for Pentode data see page 37)**	B9A (102)	6·3	0·3	100	2·3	4·0	17·5	1·4	12·5
HL13	Medium Impedance Triode	P. (44)	13	0·2	200	3·7	5·0	40	3·3	12
HL13C	Medium Impedance Triode	British 7-pin (19)	13	0·2	200	3·7	5·0	40	3·3	12
PM2A	Output Triode	British 4-pin (3)	2·0	0·2	135	6·0	5·0	12	2·0	6·0
PM2HL	Medium Impedance Triode	British 4-pin (3)	2·0	0·1	135	1·5	2·2	30	1·4	21·5
PM202	Power Triode	British 4-pin (3)	2·0	0·2	150	14	14	7	3·5	2·0
UCL11	Triode combined with Output Tetrode (for Tetrode data see page 39)	Y. (145)	60	0·1	200	2·0	2·0	65	2·1	30
354V	Medium Impedance Triode	British 5-pin (9)	4·0	0·65	250	4·5	6·5	40	3·5	11·5

TRIODES WITH DIODES

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va (V)	−Vg1 (V)	Ia (mA)	μ	gm (mA/V)	ra (KΩ)
ABC1	Double Diode Triode	P. (45)	4·0	0·65	250	7·0	4·0	27	2·0	13·5
DAC21	Single Diode Triode	Octal (132)	1·4	0·025	90	0	0·45	40	0·3	130
DAC32	Single Diode Triode	Octal (65)	1·4	0·05	90	0	0·15	65	0·275	240
EAC91	Single Diode Triode with separate Cathode for Diode	B7G (36)	6·3	0·3	200	2·8	7·5	36	2·8	12·8
EBC3	Double Diode Triode	P. (45)	6·3	0·2	250	5·5	5·0	30	2·0	15
EBC33	Double Diode Triode	Octal (62)	6·3	0·2	250	5·5	5·0	30	2·0	15
EBC41	**Double Diode Triode**	**B8A (97)**	**6·3**	**0·23**	**250**	**3·0**	**1·0**	**70**	**1·3**	**54**
KBC1	Double Diode Triode	P. (153)	2·0	0·115	135	4·5	2·5	16	1·0	16
KBC32	Double Diode Triode	Octal (61)	2·0	0·05	100	0	2·4	25	1·2	21
TDD2A	Double Diode Triode	British 5-pin (10)	2·0	0·12	135	1·5	1·95	30	1·2	25
TDD4	Double Diode Triode	British 7-pin (20)	4·0	0·65	250	7·0	4·0	27	2·0	13·5
TDD13C	Double Diode Triode	British 7-pin (20)	13·0	0·2	200	5·0	4·0	27	2·0	13·5
UBC41	**Double Diode Triode**	**B8A (97)**	**14·0**	**0·1**	**170**	**1·6**	**1·5**	**70**	**1·65**	**42**

OUTPUT PENTODES

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va=Vg2 (V)	−Vg1 (V)	Ia (mA)	Ig2 (mA)	gm (mA/V)	Pout (W)	Ra (KΩ)
AL4	Output Pentode (pa max.=9 W)	P. (46)	4·0	1·75	250	6·0	36	40	9·0	4·5	7·0
CL4	Output Pentode (pa max.=9 W)	P. (48)	33·0	0·2	200	8·5	45	6·0	8·0	4·0	4·5
CL33	Output Pentode (pa max.=9 W)	Octal (70)	33·0	0·2	200	8·5	45	6·0	8·0	4·0	4·5

OUTPUT PENTODES—*continued*

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va=Vg2 (V)	−Vg1 (V)	Ia (mA)	Ig2 (mA)	gm (mA/V)	Pout (W)	Ra (KΩ)
DL21	Output Pentode	Octal (136)	1·4	0·05	120	4·8	5·0	0·9	1·4	0·27	24
DL33	Output Pentode	Octal (69)	1·4 2·8	0·1 0·05	90 90	90 90	4·5 4·5	9·5 8·0	1·3 1·0	0·27 0·23	8·0 8·0
DL35	Output Pentode	Octal (66)	1·4	0·1	90	7·5	7·8	3·5	1·55	0·24	8·0
DL36	Output Pentode	Octal (66)	1·4	0·1	90	4·5	9·5	1·3	2·2	0·27	8·0
DL41	Output Pentode	B8A (137)	1·4 2·8	0·1 0·05	90 90	3·6 3·6	8·0 6·0	1·3 0·95	2·45 2·2	0·36 0·235	11·3 15
DL66	**Hearing-aid Output Pentode .. ..**	**B5A (121)**	**1·25**	**0·015**	**22·5**	**1·4**	**0·3**	**0·075**	**0·35**	**0·0027**	**75**
DL68	**Hearing-aid Output Pentode .. ..**	**B5A (121)**	**1·25**	**0·025**	**22·5**	**2·2**	**0·6**	**0·15**	**0·43**	**0·005**	**37·5**
DL71	Hearing-aid Output Pentode	B8D (16)	1·25	0·025	45	1·25	0·6	0·15	0·55	0·0063	100
DL72	Hearing-aid Output Pentode	B8D (16)	1·25	0·025	45	4·5	1·25	0·4	0·5	0·0195	30
DL92	**Output Pentode .. ..**	**B7G (39)**	**1·4 2·8**	**0·1 0·05**	**90* 90***	**7·0 7·0**	**7·4 6·1**	**1·4 1·1**	**1·57 1·42**	**0·27 0·235**	**8·0 8·0**
DL93	**Output Pentode suitable for R.F. or A.F. applications**	**B7G (115)**	**1·4 2·8**	**0·2 0·1**	**150†**	**8·4**	**13·3**	**2·2**	**1·9**	**0·7‡**	**8·0**
DL94	**Output Pentode .. ..**	**B7G (30)**	**1·4 2·8**	**0·1 0·05**	**90 90**	**4·5 4·5**	**9·5 7·7**	**2·1 1·7**	**2·15 2·0**	**0·27 0·24**	**10 10**
DLL21	Double Output Pentode	Octal (138)	1·4 2·8	0·2 0·1	135 135	9·4 9·5	2×8·8 2×8·2	2×2·3 2×2·4	— —	1·5 1·5	15§ 15§
ECL11	Output Tetrode (pa max.=9 W) combined with Triode (for Triode data see page 35)	Y. (145)	6·3	1·0	250	6·0	36	4·0	9·0	3·8	7·0
ECL80	**Output Pentode (pa max.=3·5 W) combined with Triode (for Triode data see page 35) .. ..**	**B9A (102)**	**6·3**	**0·3**	**170**	**6·7**	**15**	**2·8**	**3·2**	**1·0**	**11**
EL2	Output Pentode (pa max.=8 W)	P. (48)	6·3	0·2	250	18	32	5·0	2·8	3·6	8·0

* Vg2=67·5 V. † Vg2=90 V. ‡ Pout=1·2 W as R.F. Power Amplifier at 50 Mc/s (intermittent operation). § Ra-a.

OUTPUT PENTODES—*continued*

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va=Vg2 (V)	−Vg1 (V)	Ia (mA)	Ig2 (mA)	gm (mA/V)	Pout (W)	Ra (KΩ)
EL3	Output Pentode (pa max.=9 W)	P. (46)	6·3	0·9	250	6·0	36	4·0	9·0	4·5	7·0
EL11	Output Pentode (pa max.=9 W)	Y. (146)	6·3	0·9	250	6·0	36	4·0	9·0	4·5	7·0
EL12	Output Pentode (pa max.=18 W)	Y. (146)	6·3	1·2	250	7·0	72	8·0	15	8·0	3·5
EL31	Output Pentode (pa max.=25 W)	Octal (73)	6·3	1·4	275	9·0	91	11	14	120*	10*
EL32	Output Pentode (pa max.=8 W)	Octal (71)	6·3	0·2	250	18	32	5·0	2·8	3·6	8·0
EL33	Output Pentode (pa max.=9 W)	Octal (70)	6·3	0·9	250	6·0	36	4·0	9·0	4·5	7·0
EL34	Output Pentode (pa max.=25 W)	Octal (149)	6·3	1·5	250	13·5	100	14	11	12	2·0
EL35	Output Pentode (pa max.=18 W)	Octal (70)	6·3	1·35	250	15·5	72	8·0	5·0	6·0	2·5
EL37	**Output Pentode (pa max.=25 W)** ..	**Octal (70)**	**6·3**	**1·4**	**250**	**13·5**	**100**	**13·5**	**11**	**69***	**3·25***
EL38	**Line Time Base Output Pentode (pa max.=25 W)**	**Octal (73)**	**6·3**	**1·4**	**275**	**9·0**	**91**	**11**	**14**	**va(pk) max.= 8 KV**	
EL41	**Output Pentode (pa max.=9 W)** ..	**B8A (96)**	**6·3**	**0·7**	**250**	**7·0**	**36**	**5·2**	**10**	**4·2**	**7·0**
EL42	**Output Pentode (pa max.=6 W)** ..	**B8A (96)**	**6·3**	**0·2**	**225**	**10·5**	**26**	**4·1**	**3·2**	**2·5**	**9·0**
§**EL81**	**Line Time Base Output Pentode (pa max.=8 W)**	**B9A (122)**	**6·3**	**1·05**	**250**	**38·5**	**32**	**2·4**	**4·6**	**va(pk) max.= 7 KV**	
EL91	Output Pentode (pa max.=4 W)	B7G (78)	6·3	0·2	250	12·5	16	2·4	2·6	1·4	16
KL4	Output Pentode	P. (156)	2·0	0·15	135	5·0	7·0	1·1	2·1	0·44	19
KL35	Output Pentode	Octal (66)	2·0	0·15	135	4·8	5·0	—	2·2	0·31	20
KLL32	Double Output Pentode	Octal (84)	2·0	0·3	120	10·2	3·3	—	2·6†	0·94	16
PenA4	Output Pentode (pa max.=9 W)	British 7-pin (25)	4·0	1·95	250	5·8	36	5·0	9·5	3·8	8·0
PenB4	Output Pentode (pa max.=18 W)	British 7-pin (25)	4·0	2·1	250‡	12	72	7·0	8·5	8·8	3·5

* Two valves in push-pull (fixed bias). † gm at Va=Vg2=100 V, Vg1=0 V. ‡ Vg2=275 V. § Provisional information.

OUTPUT PENTODES—*continued*

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va=Vg2 (V)	−Vg1 (V)	Ia (mA)	Ig2 (mA)	gm (mA/V)	Pout (W)	Ra (KΩ)
Pen4VA	Output Pentode (pa max.=9 W)	British 5- or 7-pin (12 or 25)	4·0	1·35	250	19·5	36	3·0	2·8	3·8	6·0
Pen36C	Output Pentode (pa max.=9 W)	British 7-pin (25)	33	0·2	200	8·5	45	6·0	8·0	4·0	4·5
PL33	Output Pentode (pa max.=9 W)	Octal (70)	19	0·3	225	5·3	32	3·4	9·0	3·3	7·0
PL38	Line Time Base Output Pentode (pa max.= 25 W)	Octal (73)	30	0·3	200	5·5	75	9·0	13·5	va(pk) max= 8 KV	
PL81	**Line Time Base Output Pentode (pa max.=8 W)**	**B9A (122)**	**21·5**	**0·3**	**170**	**22**	**45**	**3·0**	**6·2**	**va(pk) max.= 7 KV**	
PL82	**Output Pentode (pa max.=9 W) ..**	**B9A (123)**	**16·5**	**0·3**	**170**	**10·4**	**53**	**10**	**9·0**	**4·0**	**3·0**
PL83	**Video Output Pentode (pa max.=9 W)**	**B9A (105)**	**15**	**0·3**	**170**	**2·3**	**36**	**5·0**	**10**	**Vout(pk) into CRT cathode= 70 V at Vb=170 V**	
PM22A	Output Pentode	British 5-pin (11)	2·0	0·15	135	4·5	5·6	—	2·2	0·34	19
PM22D	Output Pentode	British 5-pin (11)	2·0	0·3	135	2·4	5·0	0·8	3·0	0·3	24
PM24A	Output Pentode	British 5-pin (11)	4·0	0·275	300*	22·5	20	—	1·7	2·8	15
PM24M	Output Pentode (pa max.=7·5 W).. ..	British 5-pin (11)	4·0	1·1	250	17	30	5·6	3·0	2·8	7·0
QP22B	Double Output Pentode	British 7-pin (35)	2·0	0·3	135	11·7	3·8	0·5	—	1·33	14·7
UCL11	Output Tetrode (pa max.=9 W) combined with Triode (for Triode data see page 35)	Y. (145)	60	0·1	200	8·5	45	6·0	9·0	4·0	4·5
UL41	**Output Pentode (pa max.=9 W) ..**	**B8A (96)**	**45**	**0·1**	**170**	**10·4**	**53**	**10**	**9·5**	**4·0**	**3·0**

* Vg2=200 V.

OUTPUT PENTODES WITH DIODES

TYPE	DESCRIPTION	BASE	Vh (V)	Ih (A)	Va=Vg2 (V)	−Vgl (V)	Ia (mA)	Ig2 (mA)	gm (mA/V)	Pout (W)	Ra (KΩ)
ABL1	Double Diode Output Pentode (pa max.=9 W) ..	P. (50)	4·0	2·4	250	6·0	36	4·0	9·0	4·5	7·0
CBL1	Double Diode Output Pentode (pa max.=9 W) ..	P. (50)	44	0·2	200	8·5	45	6·0	8·0	4·0	4·5
CBL31	Double Diode Output Pentode (pa max.=9 W) ..	Octal (75)	44	0·2	200	8·5	45	6·0	8·0	4·0	4·5
EBL1	Double Diode Output Pentode (pa max.=9 W) ..	P. (50)	6·3	1·2	250	6·0	36	5·0	9·5	4·3	7·0
EBL21	Double Diode Output Pentode (pa max.=11 W)..	B8G (87)	6·3	0·8	250	6·0	36	5·0	9·0	4·5	7·0
EBL31	Double Diode Output Pentode (pa max.=9 W) ..	Octal (75)	6·3	1·2	250	6·0	36	5·0	9·5	4·3	7·0
Pen4DD	Double Diode Output Pentode (pa max.=9 W) ..	British 7-pin (29)	4·0	2·25	250	6·0	36	5·0	9·5	4·3	7·0
UBL1	Double Diode Output Pentode (pa max.=11 W)..	Octal (157)	55	0·1	200	11·5	55	11	8·5	5·2	3·5
UBL21	Double Diode Output Pentode (pa max.=11 W)..	B8G (87)	55	0·1	200	13	55	9·5	8·0	4·8	3·5

NONODE

TYPE	DESCRIPTION	BASE	Vh (V)	Ih (A)	TYPICAL OPERATION	
EQ80	Nonode for use as F.M. Detector and Limiter	B9A (151)	6·3	0·2	Vb 170 V Vg2+g4+g6 20 V Vg5 −4 V Vg3 −4 V Vg1 0 V Ia 0·28 mA Ig2+g4+g6 1·5 mA Ig3 0·09 mA Ig5 0·03 mA ra 5·0 MΩ	Vin(g3) r.m.s. 12 V Vin(g5) r.m.s. 12 V Phase angle between signals on g3 and g5 = 90° Ra 0·33 MΩ

TUNING INDICATORS

TYPE	DESCRIPTION	BASE	Vh (V)	Ih (A)	Va (V)	−Vgl (V)	It (mA)	Optimum Load (MΩ)
EFM1	Tuning Indicator combined with A.F. Pentode	P. (148)	6·3	0·2	250	2−20	0·65	0·13
EM1	Tuning Indicator	P. (150)	6·3	0·2	250	0−5	0·13	2·0
EM4	Dual Sensitivity Tuning Indicator	P. (51)	6·3	0·2	250 250	0−16 0−5	0·75	1·0*
EM34	**Dual Sensitivity Tuning Indicator .. ..**	**Octal (76)**	**6·3**	**0·2**	**250** **250**	**0−16** **0−5**	**0·75**	**1·0***
UM4	Dual Sensitivity Tuning Indicator	Octal (159)	12·6	0·1	200 200	0−12·5 0−4·2	1·4	1·0*
UM34	Dual Sensitivity Tuning Indicator	Octal (76)	12·6	0·1	200 200	0−12·5 0−4·2	1·4	1·0*

* Each Anode.

RECTIFIERS

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va max. (V r.m.s.)	Iout max. (mA)
AZ1	Directly Heated Full Wave Rectifier	P. (43)	4·0	1·1	2× 300	100
AZ4	Directly Heated Full Wave Rectifier	P. (43)	4·0	2·3	2× 300	200
AZ11	Directly Heated Full Wave Rectifier	Y. (130)	4·0	1·1	2× 300	100
AZ12	Directly Heated Full Wave Rectifier	Y. (130)	4·0	2·3	2× 300	200
AZ31	Directly Heated Full Wave Rectifier	Octal (55)	4·0	1·1	2× 300	100
AZ41	Directly Heated Full Wave Rectifier	B8A (131)	4·0	0·72	2× 300	70
CY1	Indirectly Heated Half Wave Rectifier	P. (42)	20	0·2	250	120
CY31	Indirectly Heated Half Wave Rectifier	Octal (53)	20	0·2	250	120
DW2	Directly Heated Full Wave Rectifier	British 4-pin (1)	4·0	1·0	2× 250	60

RECTIFIERS—*continued*

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va max. (V r.m.s.)	Iout max. (mA)
DW4/350	Directly Heated Full Wave Rectifier	British 4-pin (1)	4·0	2·0	2×350	120
DW4/500	Directly Heated Full Wave Rectifier	British 4-pin (1)	4·0	2·0	2×500	120
EY51	**Indirectly Heated H.V. Rectifier suitable for C.R.T., E.H.T. supplies .. ..**	**Wired-in B2A (119)**	**6·3** **For pulsed input:—** **P.I.V. max. = 17 KV**	**0·09**	**5,000** **Iout max. = 0·35 mA** **ik(pk) max. = 80 mA**	**3·0**
EY91	Indirectly Heated Half Wave Rectifier	B7G (54)	6·3	0·42	250	75
EZ2	Indirectly Heated Full Wave Rectifier	P. (152)	6·3	0·4	2×350	60
EZ35	Indirectly Heated Full Wave Rectifier	Octal (56)	6·3	0·6	2×325	70
EZ40	**Indirectly Heated Full Wave Rectifier ..**	**B8A (5)**	**6·3**	**0·6**	**2×350**	**90**
EZ41	**Indirectly Heated Full Wave Rectifier ..**	**B8A (5)**	**6·3**	**0·4**	**2×250**	**60**
FW4/500	Directly Heated Full Wave Rectifier	British 4-pin (1)	4·0	3·0	2×500	250
FW4/800	Directly Heated Full Wave Rectifier	British 4-pin (1)	4·0	3·0	2×850	125
GZ32	**Indirectly Heated Full Wave Rectifier ..**	**Octal (57)**	**5·0**	**2·3**	**2×300**	**300**
HVR2	Indirectly Heated Half Wave Rectifier	British 4-pin (2)	4·0	0·65	6,000	3·0
HVR2A	Indirectly Heated Half Wave Rectifier	British 4-pin (2)	2·0	1·5	6,000	3·0
IW4/350	Indirectly Heated Full Wave Rectifier	British 4-pin (7)	4·0	2·0	2×350	120
IW4/500	Indirectly Heated Full Wave Rectifier	British 4-pin (7)	4·0	2·5	2×500	120
PY31	Indirectly Heated Half Wave Rectifier	Octal (53)	17	0·3	250	125
PY80	**Indirectly Heated Booster Diode for use in Energy Recovery Circuits .. ..**	**B9A (124)**	**19** **P.I.V. max. = 4 KV** **ia(pk) max. = 400 mA**	**0·3**	**Ia(av) max. = 180 mA** **vh-k(pk) max. = 650 V**	
***PY81**	**Indirectly Heated Booster Diode for use in Energy Recovery Circuits .. ..**	**B9A (185)**	**17** **P.I.V. max. = 4·5 KV** **ia(pk) max. = 450 mA**	**0·3**	**Ia(av) max. = 150 mA** **vh-k(pk) max. = 4·5 KV**	

* Provisional information.

RECTIFIERS—*continued*

TYPE	DESCRIPTION	BASE	Vh (V)	Ih (A)	Va max. (V r.m.s.)	Iout max. (mA)
PY82	**Indirectly Heated Half Wave Rectifier** ..	**B9A (124)**	**19**	**0·3**	**250**	**180**
PZ30	Indirectly Heated Rectifier with two separate Half Wave Sections, suitable for use as Half Wave or Voltage Doubling Rectifier	Octal (17)	52	0·3	240	200*
UR1C	Indirectly Heated Half Wave Rectifier	British 5-pin (6)	20	0·2	250	75
UR3C	Indirectly Heated Multiple Rectifier	British 7-pin (18)	30	0·2	2×250	120
UY1N	Indirectly Heated Half Wave Rectifier	Octal (160)	50	0·1	250	140
UY11	Indirectly Heated Half Wave Rectifier	Y. (161)	50	0·1	250	140
UY21	Indirectly Heated Half Wave Rectifier	B8G (85)	50	0·1	250	140
UY41	**Indirectly Heated Half Wave Rectifier** ..	**B8A (14)**	**31**	**0·1**	**250**	**100**

* As voltage doubler Vout = 480 V.

VOLTAGE REFERENCE AND STABILIZING TUBES

TYPE	DESCRIPTION	BASE	V Ignition max. (V)	V Burning (V)	I max. (mA)	I min. (mA)	I Quiescent (mA)	A.C. Resistance max. (Ω)
85A1	**Neon-filled Voltage Reference Tube**	**B8G (127)**	**125**	**83–87**	**8·0**	**1·0**	**4·5**	**450**
85A2	**Neon-filled Voltage Reference Tube**	**B7G (128)**	**125**	**83–87**	**10**	**1·0**	**6·0**	**450**
***150B2**	**Inert-gas-filled Voltage Stabilizer** ..	**B7G (186)**	**180**	**143–157**	**15**	**5·0**	**10**	**500**
4687	Neon-filled Voltage Stabilizer	P. (49)	130	90–110	40	10	20	250
4687A	Neon-filled Voltage Stabilizer	British 4-pin (23)	130	90–110	40	10	20	250
7475	Neon-filled Voltage Stabilizer	British 4-pin (23)	140	90–110	8	1·0	4·0	300
13201A	Neon-filled Voltage Stabilizer	British 4-pin (23)	135	90–110	200	15	100	80

* Provisional information.

CATHODE RAY TUBES

TYPE	DESCRIPTION	LUMINESCENT COLOUR	PERSISTENCE	BASE	Vh (V)	Ih (A)	MAXIMUM FINAL† ANODE VOLTAGE	DEFLECTION SENSITIVITY
DB4-1 DG4-1 DP4-1	1¾″ Electrostatic Oscillograph Tubes for symmetrical operation	Blue Green Blue with Green afterglow	Short Medium Long	B9G (162)	6·3	0·3	1,000	Sx = 0·13 mm/V Sy = 0·21 mm/V
DB4-2 DG4-2 DP4-2	1¾″ Electrostatic Oscillograph Tubes X plates suitable for asymmetrical operation	Blue Green Blue with Green afterglow	Short Medium Long	B9G (162)	6·3	0·3	1,000	Sx = 0·13 mm/V Sy = 0·21 mm/V
DB7-5 DG7-5 DR7-5	2¾″ Electrostatic Oscillograph Tubes for symmetrical operation	Blue Green Blue with Green afterglow	Short Medium Long	B9G (162)	6·3	0·3	1,000	Sx = 0·16 mm/V Sy = 0·26 mm/V
DB7-6 DG7-6 DR7-6	2¾″ Electrostatic Oscillograph Tubes. X plates suitable for asymmetrical operation	Blue Green Blue with Green afterglow	Short Medium Long	B9G (162)	6·3	0·3	1,000	Sx = 0·16 mm/V Sy = 0·26 mm/V
*DB13-2 *DG13-2 *DP13-2	5″ Electrostatic Oscillograph Tubes with post-deflection accelerator. Suitable for symmetrical operation	Blue Green Blue with Green afterglow	Short Medium Long	B14A (163)	6·3	0·3	2,500 (Va4 max. = 5 KV)	Sx = 0·3 mm/V Sy = 0·35 mm/V (with acceleration)
ECR30	3″ Electrostatic Oscillograph Tube for symmetrical operation	Green	Medium	B12B (165)	4·0	1·0	1,000	Sx = 0·21 mm/V Sy = 0·21 mm/V
ECR35 ECR35P	3½″ Electrostatic Oscillograph Tubes for symmetrical or asymmetrical operation	Green Blue with Green afterglow	Medium Long	B12D (166)	4·0	1·0	2,500	Sx = 0·3 mm/V Sy = 0·65 mm/V
ECR60	6″ Electrostatic Oscillograph Tube for symmetrical or asymmetrical operation	Green	Medium ..	B12D (166)	4·0	1·0	2,500	Sx = 0·3 mm/V Sy = 0·575 mm/V

* Provisional information. † Design centre ratings.

CATHODE RAY TUBES—*continued*

TYPE	DESCRIPTION	LUMINESCENT COLOUR	PER-SISTENCE	BASE	Vh (V)	Ih (A)	MAXIMUM FINAL† ANODE VOLTAGE	DEFLECTION SENSITIVITY
*MF13-1	5″ Magnetic Radar Tube with metal-backed screen	Orange with Orange afterglow	Long	Octal (176)	6·3	0·3	11,000 (absolute)	$\frac{0{\cdot}3\ P.cL}{\sqrt{Va2}}$ cm./gauss Where— P is the distance of effective centre of the deflector coils from the screen centre. L is the length in cm. of the electron path through the field of the deflector coils. c is a correction factor depending upon the shape of the coils, normally about 0·5.
*MF31-22	12″ Magnetic Radar Tube with metal-backed screen	Orange with Orange afterglow	Long	B12A (116)	6·3	0·3	12,000 (absolute)	
MW6-2	2½″ Magnetic Projection Tube with metal-backed screen	White	Medium	V (117)	6·3	0·3	25,000	
MW31-16	12″ Magnetic Television Tube incorporating an ion trap and with external conductive coating	White	Medium	B12A (116)	6·3	0·3	9,000	
*MW36-22	14″ Rectangular Television Tube incorporating an ion trap and with external conductive coating	White	Medium	B12A (116)	6·3	0·3	14,000	
MW41-1	16″ Metal Cone Television Tube incorporating an ion trap	White	Medium	B12A (116)	6·3	0·3	14,000	

* Provisional information. † Design centre ratings unless otherwise specified.

THYRATRONS

TYPE	DESCRIPTION	BASE	Vh (V)	Ih (A)	va(pk) max. (KV)	P.I.V. max. (KV)	ia(pk) max. (A)	Ia max. (A)	VALVE VOLTAGE DROP (V)
EN31	Helium-filled Triode	Octal (83)	6·3	1·3	1·0	1·5	0·75	0·01	33
***ME1503**	**Hydrogen-filled Triode ..**	**B4D (175)**	**6·3**	**3·75**	**8·0**	**8·0**	**60**	**0·015**	—

* Provisional information.

THYRATRONS—*continued*

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	va(pk) max. (KV)	P.I.V. max. (KV)	ia(pk) max. (A)	Ia max. (A)	VALVE VOLTAGE DROP (V)
MT17	Mercury Vapour Triode ..	4-pin UX (177)	2·5	5·0	2·5	5·0	2·0	0·5	16
MT57	Mercury Vapour Triode ..	4-pin UX (178)	5·0	4·5	1·0	1·0	15	2·5	16
*MT105	Mercury Vapour Tetrode	B4D (179)	5·0	10	2·5	2·5	40	6·4	16
*MT5544	Inert-gas-filled Triode ..	B4D (180)	2·5	12	1·5	1·5	40	3·2	16
*MT5545	Inert-gas-filled Triode ..	B4D (180)	2·5	21	1·5	1·5	80	6·4	16
2D21	Inert-gas-filled miniature Tetrode	B7G (181)	6·3	0·6	0·65	1·3	0·5	0·1	8
1267	Cold Cathode Gas-filled Triode	Octal (184)	Cold Cathode		0·225	—	0·1	0·025	70

* Provisional information.

FLASH-TUBES

TYPE	DESCRIPTION	BASE	MAX. ENERGY OF DISCHARGE (Joules)	ANODE VOLTAGE RANGE (KV)	MIN. TRIGGER VOLTAGE (KV)	APPROX. FLASH DURATION (μ secs.)	PEAK LIGHT OUTPUT (Megalumens)	INTEGRATED LIGHT OUTPUT (Lumen-secs.)
LSD2	Microsecond Flash-Tube	Edison Screw (167)	35	7-10	8	1·0 (peak)	100	1,500
LSD3 / LSD3A	Flash-Tube for portable equipment	4-pin UX (110) / 3-pin. 5amp. (111)	100	2-2·7	4	100	35	3,000
LSD4	Flash-Tube for studio photography	3-pin special (112)	400	2-2·7	4	300	66	26,000

FLASH-TUBES—*continued*

TYPE	DESCRIPTION	BASE	MAX. ENERGY OF DISCHARGE (Joules)	ANODE VOLTAGE RANGE (KV)	MIN. TRIGGER VOLTAGE (KV)	APPROX. FLASH DURATION (μ secs.)	PEAK LIGHT OUTPUT (Megalumens)	INTEGRATED LIGHT OUTPUT (Lumen-secs.)
LSD5	**Flash-Tube for studio set, stage, and commercial colour photography**	**3-pin special (112)**	**1,000**	**2-2·7**	**6**	**500**	**80**	**40,000**
LSD7	**Flash-Tube for studio or portable equipment**	**4-pin UX (110)**	**200**	**2-2·7**	**5**	**200**	**44**	**7,000**
***LSD8**	**Stroboscopic Flash-Tube**	**4-pin UX (168)**	**30W†**	**2-2·7**	**4**	**50**	**0·06**	**—**
*LSD9	Quartz Flash-Tube for ultraviolet operation	4-pin UX (110)	1,000	2–2·7	4	600	40	25,000
LSD10	Flash-Tube for stage, studio set, and colour photography	Wired-in	10,000	2·5–4	17	3,000	250	500,000
LSD12	9″ Linear Glass Tube	Wired-in	100	2–2·7	External trigger required	80	60	4,500
LSD13	18″ Linear Glass Tube	Wired-in	600	2–2·7	„	400	65	27,000
LSD14	24″ Linear Glass Tube	Wired-in	2,500	2–2·7	„	1,300	70	150,000
LSD15	12″ Linear Glass Tube	Wired-in	200	2–2·7	„	200	50	8,000
LSD16	9″ Linear Quartz Tube	Wired-in	500	2–2·7	„	150	140	16,000
LSD17	12″ Linear Quartz Tube	Wired-in	1,000	2–2·7	„	500	100	45,000
LSD18	18″ Linear Quartz Tube	Wired-in	2,500	2–2·7	„	1,200	43	95,000

* Provisional information. † Mean power dissipation. Max. repetition rate 500 c/s (30,000 r.p.m.).

PHOTOCELLS

TYPE	DESCRIPTION	BASE	MAX. ANODE SUPPLY VOLTAGE (V)	MAX. DARK CURRENT AT MAX. ANODE SUPPLY VOLTAGE (μA)	MAX. CATHODE CURRENT (μA)	SENSITIVITY* (μA/Lumen)	MAX. GAS AMPLIFICATION FACTOR	PROJECTED CATHODE AREA (sq. cm.)
20AV	Vacuum Photocell with caesium/antimony cathode	B8G (106)	150	0·05	10	45	—	11
20CG	**Gas-filled Photocell with caesium/oxidised silver cathode**	**B8G (107)**	**90**	**0·1**	**5·0**	**150**	**10**	**6·7**
20CV	**Vacuum Photocell with caesium/oxidised silver cathode**	**B8G (107)**	**150**	**0·05**	**20**	**25 (Va=100 V)**	—	**6·7**
52CG	**Gas-filled Photocell with caesium/oxidised silver cathode**	**British 4-pin (125)**	**90**	**0·1**	**3·0**	**125**	**10**	**4·0**
55CG	**Gas-filled Photocell with caesium/oxidised silver cathode**	**B3A (American Pee-Wee) (126)**	**90**	**0·1**	**2.0**	**125**	**10**	**2·2**
57CV	**Photometric Cell with caesium/oxidised silver cathode**	**British 4-pin (182)**	**100**	**10^{-4} (Va=50 V)**	**0·5**	**13 (Va=50 V)**	—	**4·5**
58CG	**Gas-filled Photocell with caesium/oxidised silver cathode for end-on incidence of illumination**	**Wired-in (183)**	**90**	**0·1**	**1·5**	**100**	**9**	**1·1**
58CV	**Vacuum Photocell with caesium/oxidised silver cathode for end-on incidence of illumination**	**Wired-in (183)**	**100**	**0·05**	**3·0**	**20 (Va=50 V)**	—	**1·1**

* Sensitivity measured at max. anode supply voltage with the whole cathode area illuminated by a lamp of colour temperature 2700° K and with a series resistor of 1 M Ω

PHOTOCELLS—*continued*

TYPE	DESCRIPTION	BASE	MAX. ANODE SUPPLY VOLTAGE (V)	MAX. DARK CURRENT AT MAX. ANODE SUPPLY VOLTAGE (μA)	MAX. CATHODE CURRENT (μA)	SENSITIVITY* (μA/Lumen)	MAX. GAS AMPLIFICATION FACTOR	PROJECTED CATHODE AREA (sq. cm.)
90AG	Gas-filled Photocell with caesium/antimony cathode	B7G (108)	90	0·1	2·5	150	7	4·0
90AV	Vacuum Photocell with caesium/antimony cathode	B7G (108)	100	0·05	5·0	45	—	4·0
90CG	Gas-filled Photocell with caesium/oxidised silver cathode	B7G (109)	90	0·1	2·0	125	10	3·1
90CV	Vacuum Photocell with caesium/oxidised silver cathode	B7G (109)	100	0·05	10	20 (Va=50V)	—	3·1

* Sensitivity measured at max. anode supply voltage with the whole cathode area illuminated by a lamp of colour temperature 2700°K and with a series resistor of 1 MΩ.

NOTE.—Caesium/antimony cathode is particularly sensitive to daylight and bluish light.
Caesium/oxidised silver cathode is particularly sensitive to incandescent light and to near infra-red radiation.

IMAGE CONVERTERS

TYPE	DESCRIPTION	BASE NO.	PHOTO-CATHODE	SENSITIVITY OF PHOTOCATHODE (μA/Lumen)	LUMINESCENT SCREEN	Va-k max. (KV)	LINEAR MAGNIFICATION OF IMAGE	SCREEN RESOLUTION (Lines/cm.)
*ME1200AA	Magnetically focused Image-converter sensitive to daylight and bluish light	171	Caesium/Antimony	20	Blue Short persistence	6	3-7	200

* Provisional information.

IMAGE CONVERTERS—*continued*

TYPE	DESCRIPTION	BASE NO.	PHOTO-CATHODE	SENSITIVITY OF PHOTOCATHODE (μA/Lumen)	LUMIN-ESCENT SCREEN	Va-k max. (KV)	LINEAR MAGNIFI-CATION OF IMAGE	SCREEN RESOLUTION (Lines/cm.)
*ME1201AA	Grid controlled magnetically focused Image-converter sensitive to daylight and bluish light	172	Caesium/ Antimony	20	Blue Short persistence	6	2·5-3·5	200
				For typical operation, Vg-k = 3 KV For extinction of image Vg-k = −20 V				
*ME1202CA	Magnetically focused Image-converter sensitive to near infra-red radiation	173	Caesium/ oxidised silver	15	Blue short persistence	6	1	200

Variants of these tubes with different photocathodes and luminescent screens are also available, and are distinguished by the last two letters of the type number. * Provisional information.

U.H.F. VALVES

TYPE	DESCRIPTION	BASE NO.	Vh (V)	Ih (A)	CHARACTERISTICS
ME1001	Disc Seal Triode for use as a common-grid earthed-anode concentric line oscillator	169	6·3	0·4	Va = 250 V Vg = −3·5 V Ia = 20 mA μ = 30 gm = 6 mA/V
*ME1005	Disc Seal Triode for use as a voltage amplifier	169	6·3	0·4	Va = 250 V Vg = −1·3 V Ia = 10 mA μ = 70 gm = 6·5 mA/V

* Provisional information.

U.H.F. VALVES—*continued*

TYPE	DESCRIPTION	BASE NO.	Vh (V)	Ih (A)	CHARACTERISTICS
*ME1100	Mechanically Tuned Reflex Klystron for use as a 3 cm. local oscillator	—	6·3	0·6	Frequency Range = 8,500-9,660 Mc/s. Max. resonator voltage = 350 V Max. resonator current = 30 mA Max. reflector voltage = –350 V Min. power output = 20 mW Base:—Octal with coaxial line at pin 4
*ME1101	3 cm. Fixed Frequency Packaged Magnetron	—	6·3	0·5	Frequency range = 9,345-9,405 Mc/s. Va max. = 5·7 KV } pulsed Ia max. = 7 A } pulsed Max. duty cycle = 0·001 Max. pulse length = 2·5 μ sec. Max. power output = 14 KW

* Provisional information.

ACCELEROMETER TUBE

TYPE	DESCRIPTION	BASE	Vh (V)	Ih (A)	CHARACTERISTICS
DDR100	Accelerometer Double Diode	B8G (164)	6·3	0·6	Va max. = 10 V †Sensitivity = 7·5 mv/g Max. acceleration = 100 g

† Across resistance bridge.

ELECTROMETERS

TYPE	DESCRIPTION	BASE	Vf or Vh (V)	If or Ih (A)	Va (V)	Ig2 (V)	—Vg1 (V)	Ia (μA)	Ig1 (A)	gm (μA/V)	μ
ME1400	Electrometer Pentode	Octal (72)	4·5	0·16	△45 ●45	45 —	2·0 2·0	80 100	$<10^{-11}$ $<10^{-11}$	240 300	— 20
*ME1401	Subminiature Electrometer Triode	Wired-in (174)	1·25	0·013	9	—	2·5	100	$<12{\cdot}5\times10^{-14}$	80	1·7

* Provisional information. △ Pentode connected. ● Triode connected.

DIRECT REPLACEMENT GUIDE
(including obsolete Mullard Valves)

Types marked with asterisk (*) are replacements in AC receivers only. In AC/DC receivers it will be necessary to shunt the heater of the replacement valve, as the heater current of this valve differs from that of the original type.

The data provided on this chart assumes that the valve to be substituted was being operated under the manufacturer's recommended conditions.

Type Number	Replacement	Type Number	Replacement	Type Number	Replacement
AB1	†	AZ3	†	CB1	†
AC/DD (Hivac)	**2D4A**	AZ32	†	CB2	†
AC/DD (Mazda)	†	AZ33	†	CBC1	†
AC/DDT	**TDD4**	A11B	**1W4/350**	CC2	**HL13**
AC/HL	**354V**	A11C	**1W4/500**	CF1	**SP13**
AC/HLDD	**TDD4**	A11D	**1W4/350**	CF2	**VP13A**
AC/HP	**SP4**	A20B	**2D4A**	CF3	†
AC/PEN	**PEN4VA**	A23A	**TDD4**	CF7	**SP13**
AC/Q	†	A27D	**PEN4DD**	CK1	**FC13**
AC/Qa	†	A30D	**354V**	CL6	†
AC/SG	†	A36A	**TH4**	CY1C	**UR1C**
AC/SGVM	†	A36B	**TH4B**	CY2	†
AC/SH	†	A36C	**TH4B**	CY32	†
AC/SL	**SP4**	A40M	†	C10B	**UR1C**
AC/S1VM	**VP4**	A50A	**SP4**	C12FM	**MW31-16**
AC/S2	**SP4**	A50B	**SP4B**	C20C	†
AC/S2PEN	†	A50M	**VP4 (7-pin)**	C23B	**TDD13C**
AC/TH1	**TH4B**	A50N	**VP4A**	C27D	†
AC/VH	†		**(7-pin)**	C30B	**HL13C**
AC/VP (5-pin)	†	A50P	**VP4B**	C36A	**TH21C**
AC/VP (7-pin)	**VP4A**	A70B	**PEN4VA**	C36C	**TH30C**
AC/VPB	**VP4B**		**(7-pin)**	C50B	**SP13C**
AC/VP1	†	A70C	**PENA4**	C50N	**VP13C**
AC/VP2	**VP4B**	A70D	**PENA4**	C70D	**PEN36C**
AC/Y	†	A70E	**PENB4**	C80B	**FC13C**
AC/Z	**PENA4**	A80A	**FC4**	DA	†
AC/2DD	†	A430N	**354V**	DAC1	†
AC2/PEN	**PENA4**	BVA211	**DW4/350**	DD4	**2D4A**
AC2/PENDD	†	BVA214	**or**	DD4s	**AB2**
AC4/PEN	**PENB4**	BVA215	**1W4/350**	DD6 (Cossor	**EB91**
AF2	†	BVA216		Ferranti)	
AL5	†	BVA243		DD6	
AL60	†	BVA246	**EF39**	(Tungsram)	†
APP4A	**PEN4VA**	BVA247		DD6ds	**EB4**
APP4As	†	BVA264		DD13	†
APP4B	**PENA4**	BVA265	**EL33**	DD13s	†
APP4Bs	**AL4**	BVA266		DD465	†
APP4E	**PENB4**	BVA267		DD620	†
APV4	**1W4/350**	BVA274		DDA1	**2D4A**
AS4120	**SP4**	BVA275	**ECH35**	DDL4	**2D4A**
AS4125	†	BVA276		DDPP4B	†
AZ2	†	B228	**PM2HL**	DDPP4Bs	**ABL1**

† No direct replacement available. Please refer to Near Equivalent Guide.

Type Number	Replacement	Type Number	Replacement	Type Number	Replacement
DDPP4M	**PEN4DD**	ECH41	†	HP210nc (4-pin)	†
DDPP6B	†	EF2	†	HP211c	**VP2**
DDPP6Bs	**EBL1**	EF5	**EF9**	HP215 (Hivac)	†
DDPP39	†	EF6	†	HP4101c	**SP4**
DDPP39M	†	EF8	**EF9**	HP4105	**VP4**
DDPP39s	**CBL1**	EF38	**EF39**	HP4106c	**VP4**
DDT	†	EK3	†	HP4115c (5-pin)	†
DDT2	**TDD2A**	EL3N	**EL3**	HP4115c (7-pin)	**VP4A**
DDT4	**TDD4**	EL5	†	HR210	**PM2HL**
DDT4s	**ABC1**	EL6	†	H2	**PM2HL**
DDT6s	**EBC3**	EL36	†	H2D	**TDD2A**
DDT13	**TDD13C**	EZ1	†	H4D	†
DDT13s	†	E220B	**PM2B**	H210	**PM2HL**
DDT215	†	E235	**PM202**	IW3	**IW4/350**
DDT220	**TDD2A**	FG17	**MT17**	IW4	**IW4/500**
DET22	**ME1001**	FG57	**MT57**	KT2	**PM22A**
DF1	†	FG105	**MT105**	KT24	**PM22A**
DH42	**TDD4**	GN24	**DW4/350**	KT41	†
DH63	†	G431	**DW2**	KT42	**PEN4VA**
DH63M	**EBC33***	G470	**DW2**	KT61	†
DH142	**UBC41**	G2080 (5-pin)	**URIC**	KT63	†
DH147	**EBC33**	G2080 (P base)	**CY1**	KT66	**EL37**
DH150	**EBC41**	G4120	**DW4/500**	KTW61	†
DK1	†	G4120N	**IW4/500**	KTW61M	†
DL2	†	HAD	†	KTW63	†
DL63	**EBC33***	HD14	**DAC32**	KTZ63	†
DL91	†	HD22	**TDD2A**	K23B	**TDD2A**
DN41	†	HD23	**TDD2A**	K30A	**PM2HL**
DN143	**EBL21**	HD24	**TDD2A**	K30B	†
DO42	**PEN4DD**	HL2	**PM2HL**	K30C	**PM2HL**
DP61	**EF95**	HL2K	**PM2HL**	K30D	**PM2HL**
DP495	**PEN4DD**	HL4+	**354V**	K30G	**PM2A**
DP4480	†	HL4g	†	K30K	**PM2HL**
DT41	**TDD4**	HL4gs	†	K40B	†
DT436	**TDD4**	HL13	**HL13C**	K40N	**PM12M**
DT1336 (7-pin)	**TDD13C**	(Tungsram)		K50M	**VP2**
DTU1	**TDD13C**	HL13 (Hivac)	†	K50N	**VP2B**
DW3	**DW4/350**	HL13s	**HL13**	K70B	**PM22A**
DW4	**DW4/500**	HL21DD	**TDD2A**	K70D	**PM22D**
D4	**354V**	HL22	†	K77B	**QP22B**
D41	**2D4A**	HL23DD	†	K80A	**FC2**
D63	**EB34***	HL41	†	K80B	**FC2A**
D77	**EB91**	HL41DD	†	K435/10	**ACO44**
D152	**EB91**	HL133DD	†	LD210	†
D400	**2D4A**	HL210	**PM2HL**	LL2	**PM2HL**
D1300	†	HLA2	**354V**	LL2s	†
EAF41	†	HLB1	†	LN152	**ECL80**
EC50	†	HL/DD1320	†	LP2 (Osram)	**PM2A**
EC55	**ME1001**	HP13	†	LP2 (Ferranti)	**PM202**
ECH2	†	HP13s	**VP13A**	LP4	**ACO44**
ECH4	†	HP210nc (7-pin)	**SP2**	LP220	**PM2A**

** See note at beginning of section.* *† No direct replacement available. Please refer to Near Equivalent Guide.*

DIRECT REPLACEMENT GUIDE

Type Number	Replacement	Type Number	Replacement	Type Number	Replacement
L2 (Ferranti)	**PM2A**	OM5	**EF36**	PP6BG	**EL33**
L2 (Mazda)	**PM2HL**	OM5A	**EF37**	PP6Bs	**EL3**
L2/B	**PM2HL**	OM5B	**EF37A**	PP34	†
L2/DD	†	OM6	**EF39**	PP34s	**CL4**
L21	**PM2HL**	OM7	**EF39**	PP35	**PEN36C**
L21/DD	**TDD2A**	OM9	**EL32**	PP36	†
L210	**PM2HL**	OM10	**ECH35***	PP220	**PM202**
ME6s	**EM1**	OP41	**PENB4**	PP3/250	**ACO44**
MH4	**354V**	OP42	**PENA4**	PT2	**PM22A**
MHD4	†	O202	**FC2**	PT4 Marconi	
MHL4	†	O406	**FC4**	Osram	**PM24M**
MKT4	**PEN4VA**	O1307 (P base)	**FC13**	PT4 (Ferranti)	**PENA4**
MM4V	†	O1307 (7-pin)	**FC13C**	PT4D	†
MP4106c	**VP4**	PB1	**PM2A**	PT41	**PM24M**
MP/PEN	**PEN4VA**	PEN4V	†	PTZ	†
MPT4	**PEN4VA**	PEN4VB	**PENA4**	PV4	**DW4/350**
MS4B	**SP4**	PEN24	†	PV29s	†
MS4C	**SP4**	PEN25	†	PV30	**UR3C**
MSG/HA	**SP4**	PEN26	†	PV30s	†
MSG/LA	**SP4**	PEN40DD	†	PV495	**DW2**
MSP4	**SP4**	PEN220	**PM22A**	PV4200	**DW4/500**
MS/PEN	**SP4**	PEN230	†	PVB6s	†
MS/PENA	**SP4**	PEN231	**PM22D**	PX4	**ACO44**
MU12	**IW4/350**	PEN3520	**PEN36C**	PX230	**PM202**
MU12/14	**IW4/500**	PENA1	**PM24M**	P2	**PM202**
MU14	**IW4/500**	PENB1	**PM22A**	P12/250	**ACO44**
MV/SG	†	PENDD4020	†	P220	†
MVS/PEN	†	PL17	**MT17**	(Tungsram)	
(5-pin)		PL21	**2D21**	P220 Mazda	
MVS/PEN	**VP4A**	PL57	**MT57**	Hivac	**PM2A**
(7-pin)		PL105	**MT105**	P220A	**PM202**
MVS/PENB	†	PL1267	**1267**	P225 (5-pin)	**PM22A**
N14	**DL35**	PM1A	**PM2HL**	P240	**PM202**
N15	†	PM1HF	**PM2HL**	P435	**PM24M**
N16	**DL33**	PM1HL	**PM2HL**	P440N	**PEN4VA**
N17	**DL92**	PM1LF	†	P441N	**PEN4VA**
N19	**DL94**	PM2	†	P495	**PENA4**
N40	†	PM2DL	**PM2HL**	QP230	**QP22B**
N41	**PENA4**	PM2DX	**PM2HL**	QP240 (Mazda)	†
N63	†	PM12	†	QP240 (Hivac)	†
N66	**EL37**	PM12A	†	QPT2	†
N77	**EL91**	PM22	†	QS83/3	**85A2**
N142	**UL41**	PM24	†	RV120/350	**DW4/350**
N144	**EL91**	PM24B	†	RV120/350s	**AZ1**
N147	**EL33**	PM24C	†	RV120/500	**DW4/500**
N150	**EL41**	PM252	†	RV120/500s	†
N151	**EL42**	PP2	**PM22A**	RV200/600	**FW4/800**
N152	**PL81**	PP2s	**KL4**	RZ	**UR1C**
OM1	**CY31**	PP4	**PM24M**	R1	**DW2**
OM3	**EB34**	PP4s	†	R2	**IW4/350**
OM4	**EBC33**	PP6As	**EL2**	R3	**IW4/500**

** See note at beginning of section.   † No direct replacement available.   Please refer to Near Equivalent Guide.*

DIRECT REPLACEMENT GUIDE

Type Number	Replacement
R4	**DW4/350**
R4A	**DW4/500**
R12	**EY51**
R14	**PZ30**
R41	**DW4/500**
R42	**IW4/350**
R52	**GZ32**
SD2	**PM2HL**
SE211c	**PM12M**
SG215	**PM12M**
SG215A	**PM12M**
SP4 (Tungsram)	†
SP4C	†
SP4s	**AF7**
SP6	**EF91**
SP6s	†
SP13 (Tungsram)	†
SP13B	**SP13C**
SP13s	**SP13**
SP22	†
SP210	**SP2**
SP215	†
SP220	**PM202**
SP1320	**SP13C**
SPT2	**SP2**
SPT4A	**SP4** (7-pin)
SS210	†
SU61	**EY51**
S4V	**SP4**
S4VA	**SP4**
S4VB	**SP4**
S11A	**DW2**
S11D	**DW4/350**
S21	†
S22	†
S23	†
S24	†
S30C	**ACO44**
S30D	†
S213	**PM12M**
S215	†
S215A	†
S215B	†
S215VM	**PM12M**
S217	**VP2**
S218	**SP2**
S420	**VP4B**
S434N (5-pin)	†
S434N (7-pin)	**VP4A**
S435N	**SP4**

Type Number	Replacement
S1324	†
S1328	**SP13**
TDD2	†
TDD13	†
TH4	†
TH4A	**TH4B**
TH22C	**TH30C**
TH29	**TH30C**
TH30	**TH30C**
TH41	†
TH62	†
TH233	†
TH2321	**TH30C**
TP25	†
TT4	†
TV4	†
TV6	**EM1**
TX4	†
TX21	**TH21C**
TX41	**TH4B**
T41 (Ekco)	**354V**
UAF41	†
UCH4	†
UCH41	†
UD2	**PM202**
UR1	**CY1**
UR2	†
UR3	†
UU3	**IW4/350**
UU4	**IW4/350**
UU5	**IW4/500**
UU6	†
UU8	†
UU9	**EZ40**
UU60/250	**IW4/350**
UU120/350	**DW4/350**
UU120/350A	**IW4/350**
UU120/500 (Mazda)	**DW4/500**
UU120/500 (Hivac)	**IW4/500**
UY31	†
U10	**DW2**
U12/13	**DW4/350**
U14	**DW4/500**
U18/20	**FW4/500** **FW4/800**
U31	**PY31**
U50	†
U70	**EZ35**
U82	†

Type Number	Replacement
U84	†
U101	†
U142	**UY41**
U143	**AZ31**
U145	**UY41**
U147	**EZ35**
U149	†
U150	**EZ40**
U151	**EY51**
U152	**PY80**
U201	**CY31**
U403	†
U404	**UY41**
U4020	†
VHT2	**FC2**
VHT2A	**FC2A**
VHT4	**FC4**
VHTA	†
VM4V	†
VMP4	**VP4**
VMP4G	†
VMS4	†
VMS4B	†
VO2	**FC2A**
VO2s	**KK2**
VO4	**FC4**
VO4s	**AK2**
VO6s	**EK2**
VO13	**FC13C**
VO13s	**FC13**
VP4C	†
VP6	**EF92**
VP13	†
VP13B	**VP13C**
VP22	†
VP41 (Mazda)	†
VP41 (Ekco)	**VP4B**
VP133	†
VP210	†
VP215	†
VP1321	†
VP1322	**VP13C**
VPT2	†
VPT4	**VP4** (5-pin)
VPT4B	**VP4A**
VPU1	**VP13C**
VS2	**PM12M**
VS24	**PM12M**
VS24K	**PM12M**
VS210	**PM12M**
VS215	**PM12M**

† *No direct replacement available. Please refer to Near Equivalent Guide.*

DIRECT REPLACEMENT GUIDE

Type Number	Replacement	Type Number	Replacement	Type Number	Replacement
VX2	VP2B	1A7VG	DK32	4D1	†
VX2s	†	1AC6	DK92	4G/280K	2D21
VX32	ME1401	1C1 (Mazda)	DK91	4THA	†
V20	UR1C	1C5G	DL35	4XP	ACO44
V20s	CY1	1C5GT/G	DL35	4/100BU	FW4/500
V30	†	1C6	†	5CP1–A	DG13-2
WD142	UAF42	1C7G	†	5CP7–A	DP13-2
WD150	EAF42	1D5	†	5FP7–A	MF13-1
W17	DF91	1D6	†	5V4G	GZ32
W21	†	1D7G	†	5Y3G	†
W42	†	1D13	DA90	5Y4G	†
W63	†	1E5G	†	5Z4G	GZ32
W77	EF92	1F2	DF92	6A6	†
W142	UF41	1F3	DF91	6A7	†
W143	EF22	1F4	†	6A7E	†
W147	EF39	1F5G	KL35	6A8G	†
W150	EF41	1FD9	DAF91	6A8GT	†
X14	DK32	1H5G	DAC32	6AB8	ECL80
X17	DK91	1H5GT/G	DAC32	6AG6G	EL33
X21	FC2	1H6G	†	6AK5	EF95
X22	FC2	1L4	DF92	6AK6	†
X42	†	1LA6	†	6AL5	EB91
X61M	ECH35	1LC5	†	6AM5	EL91
X65	†	1LD5	†	6AM6	EF91
X142	UCH42	1LH4	†	6AT6	†
X143	ECH21	1LN5	†	6BD6	†
X147	ECH35	1N5G	†	6BE7	EQ80
X150	ECH42	1N5GT/G	DF33	6BT6	†
YD2	†	1N5VG	DF33	6BX6	EF80
Y61	†	1P10	DL92	6C6	†
Y62	†	1P11	DL94	6C10	ECH42
Y63	†	1Q5GT	DL36	6CJ6	EL81
Y220	†	1R5	DK91	6D1 (Mazda)	EA50
ZD17	DAF91	1S4	†	6D2	EB91
ZD152	EBF80	1S5	DAF91	6D6	†
Z14	DF33	1T4	DF91	6E8G	ECH35
Z21	†	1U5	†	6F12	EF91
Z22	SP2	2D4	†	6F16	EF41
Z77	EF91	2D13	†	6H6GT	EB34*
Z90	EF50	2D13A	†	6J6	ECC91
Z142	UF42	2D13C	†	6J7G	†
Z150	EF42	2D21	2D21	6J7GT	EF37A*
Z152	EF80	2J42	ME1101	6J8G	†
0A4G	1267	3A4	DL93	6K7G	†
0E3	85A1	3A5	DCC90	6K7GT	EF39*
1A3	DA90	3NP4	MW6-2	6K8G	†
1A4E	†	3Q4	†	6K8GT	†
1A4P	†	3Q5GT/G	DL33	6L6G	†
1A7G	†	3S4	DL92	6L34	EC91
1A7GT/G	DK32	3V4	DL94	6M6G	EL33

** See note at beginning of section.   † No direct replacement available. Please refer to Near Equivalent Guide.*

DIRECT REPLACEMENT GUIDE

Type Number	Replacement	Type Number	Replacement	Type Number	Replacement
6N7GT/G	†	16A5	**PL82**	210SPG	**FC2**
6N8	**EBF80**	17Z3	**PY81**	210SPT	†
6P8G	**ECH35***	19X3	**PY80**	210VPT (4-pin)	†
6P28	†	19Y3	**PY82**	210VPT (7-pin)	†
6Q7G	†	20A1	**TH4B**	215P	†
6Q7GT	†	20A3	**2D21**	215SG	**PM12M**
6S7	**EF39***	21A6	**PL81**	220HPT	**PM22A**
6S7G	†	25RE	†	220/OT	**PM22A**
6SC7	†	25Y5	†	220P	†
6SJ7	†	25Z4G	†	220PA	**PM2A**
6SK7	†	25Z5	†	220SG	†
6SL7GT	**ECC35***	25Z6G	†	220VS	**PM12M**
6SN7GT	†	35RE	†	220VSG	**PM12M**
6U5/6G5	†	36	†	230PT	†
6U7G	†	39/44	†	230XP	†
6V6G	†	40SUA	†	240QP	**QP22B**
6W7G	†	41E	†	244V	**354V**
6X2	**EY51**	41/MHF	**354V**	302THA	**TH30C**
6X5G	**EZ35**	41/MHL	**354V**	332PEN	**CL33**
6X5GT/G	**EZ35**	41/MPG	**FC4**	408BU	**DW2**
6ZY5G	†	41/MPL	**354V**	442BU	**DW4/350**
7A2	**PEN4VA**	41/MSG	**SP4**	460BU	**DW4/500**
7A3	**PENA4**	41/MTL	**354V**	484V	†
7A7	†	41STH	†	506BU	**DW2**
7B7	†	42/42E	†	723A/B	**ME1100**
7C5	†	42MP/PEN	**PENA4**	927	**55CG**
7D6	**PEN36C**	42/OT	**PENA4**	1267	**1267**
7D9	**EL91**	431U	**1W4/350**	1561	**DW4/500**
7F7	†	441U	**1W4/500**	1821	**DW2**
7K7	†	451U	†	1861	**1W4/500**
7S7	†	54KU	**GZ32**	1867	**1W4/350**
7Y4	†	62DDT	**EBC41**	1877	**HVR2**
8A1	**SP4**	62TH	**ECH42**	1881	**1W4/350**
8D2	†	62VP	**EF41**	2101	†
8D3	**EF91**	63SPT	**EF50**	2102	†
9A1	**VP4**	64ME	**EM34**	4065	**ME1401**
9D2	†	66KU	**EZ40**	5544	**MT5544**
9D6	**EF92**	67PT	**EL41**	5545	**MT5545**
10D1	†	77/77E	†	5557	**MT17**
11A2	†	78/78E	†	5559	**MT57**
12AT7	**ECC81**	80	†	5802	**ME1401**
12XP4	**MW31-16**	84/6Z4	†	5861	**ME1001**
12Z3	†	121K	**MW31-16**	55035	**ME1101**
13PGA	†	202DDT	**TDD13C**		
13SPA	†	202STH	**TH21C**		
13VPA	†	210DDT	**TDD2A**		
15	†	210DET	**PM2HL**		
15A2	†	210HF	**PM2HL**		
15A6	**PL83**	210LF	†		
15D1	†	210PG	**FC2**		

** See note at beginning of section.* *† No direct replacement available. Please refer to Near Equivalent Guide.*

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Type Number	BASE	Mullard Replacement	BASE	CONVERSION
AB1	O	**2D4A**	O	No circuit change. 2D4A has no top cap.
AC/DD (Mazda)	O	**2D4A**	O	No circuit change. 2D4A has no top cap.
AC/Q	M	**PENB4**	M	Bias may require adjustment.
AC/Qa	K	**EL37**	K	Bias may require adjustment.
AC/SG	O/M	**SP4**	O/M	Raise Vg2 to 100V for R.F. amplifier.
AC/SGVM	O/M	**VP4**	O/M	Raise Vg2 to 100V for R.F. amplifier.
AC/SH	M	**SP4**	M	Bias may require adjustment.
AC/S2PEN	M	**SP4**	M	Bias may require adjustment.
AC/VH	O	**VP4**	O	Bias may require adjustment.
AC/VP (5-pin)	O	**VP4A**	M	Change base.
AC/VP1	M	**VP4B**	M	Rewire base.
AC/Y	O/M	**PEN4VA**	O/M	Bias may require adjustment.
AC/2DD	M	**PEN4DD**	M	Interchange connections to pins 2 and 6.
AC2/PENDD	M	**PEN4DD**	M	Rewire base.
AF2	O	**VP4A**	M	Change base.
AL5	P	**PENB4**	M	Change base.
AL60	M	**PENB4**	M	Rewire base. Change Rk to 175Ω.
APP4As	P	**PEN4VA**	O/M	Change base.
AS4125	O	**VP4**	O	Volume control will be less gradual in operation.
AZ2	P	**FW4/500**	A	Change base.
AZ3	P	**1W4/350**	A	Change base.
AZ32	K	**FW4/500**	A	Change base.
AZ33	K	**1W4/350**	A	Change base.
A40M	O	**VP4**	O	Volume control will be less gradual in operation.
CB1 CB2	V V	**EB34**	K	Change base. When rewiring connect separate cathodes of EB34 together. EB34 : Vh=6·3V.
CBC1	P	**TDD13C**	M	Change base.
CF3	P	**VP13C**	M	Raise Vg2 to Va.
CL6	P	**CL4**	P	Change Rk to 170Ω. Raise Vg2 to 200V.
CY2	P	**UR3C**	M	Change base.
CY32	K	**UR3C**	M	Change base.
C20C	O	**EB34**	K	Change base. When rewiring connect separate cathodes of EB34 together. EB34 : Vh=6·3V.
C27D	M	**CBL31**	K	Change base.
DA	M	**HL13C**	M	Bias may require adjustment.
DAC1	P	**DAC32**	K	Change base.

Type Number	BASE	Mullard Replace-ment	BASE	CONVERSION
DD6 (Tungsram)	O	**EB34**	K	Change base.
DD13 DD13s	O V	**EB34**	K	Change base. When rewiring connect separate cathodes of EB34 together. EB34 : Vh=6·3V.
DD465	O	**2D4A**	O	Rewire base.
DD620	O	**EB34**	K	Change base.
DDPP4B	M	**PEN4DD**	M	Rewire base.
DDPP6B	M	**EBL31**	K	Change base.
DDPP39	M	**CBL31**	K	Change base.
DDPP39M	M	**CBL31**	K	Change base.
DDT	M	**TDD4**	M	Bias may require adjustment.
DDT13s	P	**TDD13C**	M	Change base.
DDT215	O	**TDD2A**	O	Bias may require adjustment.
DF1	P	**DF33**	K	Change base.
DH63	K	**EBC33***	K	Earth pin 1.
DK1	P	**DK32**	K	Change base.
DL2	P	**DL35**	K	Change base.
DL91	B7G	**DL92**	B7G	Rewire base so that Vf is between pin 5 and pins 1 and 7 connected together.
DN41	M	**PEN4DD**	M	Rewire base. Raise Vg2 to Va. Increase Rk to 140 Ω.
DP4480	M	**CBL31**	K	Change base.
D1300	P	**EB34**	K	Change base. When rewiring connect separate cathodes of EB34 together. EB34 : Vh=6·3V.
EAF41	B8A	**EAF42**	B8A	Connect pins 4 and 7 together.
EC50	P	**EN31**	K	Change base.
ECH2	P	**ECH3**	P	ECH3 : Ih=0·3A.
ECH4	P	**ECH21**	B8G	Change base.
ECH41	B8A	**ECH42**	B8A	Screen grid resistors may need alteration.
EF2	P	**EF9**	P	Bias may require adjustment.
EF6	P	**EF36**	K	Change base.
EK3	P	**EK2**	P	Raise Vg2 to 200V. EK2 : Ih=0·2A.
EL5	P	**EL35**	K	EL35 : Vg2=250V max. Change Rk to 180 Ω. Change base.
EL6	P	**EL35**	K	EL35 : Vg2=250V max. Change Rk to 180 Ω. Change base.
EL36	K	**EL35**	K	EL35 : Vg2=250V max. Change Rk to 180 Ω.
EZ1	P	**EZ35**	K	Change base. EZ35 : Ih=0·6A.
HAD	M	**TDD13C**	M	Bias may require adjustment.
HL4g	M	**354V**	O	Change base.
HL4gs	P	**354V**	O	Change base.
HL13 (Hivac)	M	**HL13C**	M	Shunt heater with 130 Ω, 2W resistor.
HL22	MO	**PM2HL**	A	Change base.
HL23DD	MO	**KBC32**	K	Change base.

Type Number	BASE	Mullard Replacement	BASE	CONVERSION
HL41	MO	**354V**	O	Change base.
HL41DD	MO	**TDD4**	M	Change base.
HL133DD	MO	**TDD13C**	M	Change base.
HLB1	A	**PM2HL**	A	Bias may require adjustment.
HL/DD1320	M	**TDD13C**	M	Bias may require adjustment.
HP13	M	**VP13A**	P	Change base.
HP210nc (4-pin)	A	**SP2**	M	Change base.
HP215 (Hivac)	M	**SP2**	M	Raise Vg2 to Va.
HP4115c (5-pin)	O	**VP4A**	M	Change base.
H4D	M	**TDD4**	M	Bias may require adjustment.
KT41	M	**PENA4**	M	Bias may require adjustment.
KT61	K	**EL33**	K	Bias may require adjustment.
KT63	K	**EL32**	K	Rewire base.
KTW61	K	**EF39***	K	Earth pin 1. Bias may require adjustment.
KTW61M	K	**EF39***	K	Bias may require adjustment.
KTW63	K	**EF39***	K	Earth pin 1.
KTZ63	K	**EF37A***	K	Connect pin 5 to pin 8.
K30B	A	**PM2HL**	A	Change Vg1 to −1·5V.
K40B	A	**PM12M**	A	Raise Vg2 to 90V.
LD210	A	**PM2HL**	A	Bias may require adjustment.
LL2s	P	**PM2HL**	A	Change base.
L2/DD	O	**TDD2A**	O	Change Vg1 to −1·5V. Not suitable as Class B driver.
MHD4	M	**TDD4**	M	Bias may require adjustment.
MHL4	O	**354V**	O	Bias may require adjustment.
MM4V	O	**VP4**	O	Volume control less gradual in operation.
MV/SG	O	**VP4**	O/M	Bias may require adjustment.
MVS/PEN (5-pin)	O	**VP4A**	M	Change base.
MVS/PENB	M	**VP4B**	M	Raise Vg2 to Va.
N15	K	**DL33**	K	Increase bias.
N40	O	**PEN4VA**	O/M	Bias may require adjustment.
N63	K	**EL32**	K	Rewire base.
PEN4V	O	**PEN4VA**	O	Change Vg1 to −22V. No change with automatic bias.
PEN24	MO	**KL35**	K	Change base. Change Vg1 to −4·5V.
PEN25	MO	**KL35**	K	Change base.
PEN26	P	**CL4**	P	Change Rk to 170 Ω. CL4 : Vg2=200V.
PEN40DD	M	**CBL31**	K	Change base.
PEN230	A/O	**PM22A**	A/O	Change Vg1 to −4·5V at Va=Vg2=135V and Ra to approximately 19K Ω.
PENDD4020	M	**CBL31**	K	Change base.
PM1LF	A	**PM2HL**	A	Change Vg1 to −1·5V.
PM2	A	**PM2A**	A	Change Vg1 to −6V.
PM12	A	**PM12M**	A	Raise Vg2 to 90V.

**See note at beginning of Direct Replacement Guide.*

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Type Number	BASE	Mullard Replacement	BASE	CONVERSION
PM12A	A	**PM12M**	A	Raise Vg2 to 90V.
PM22	A/O	**PM22A**	A/O	Change Vg1 to −4·5V at Va=Vg2=135V and Ra to approximately 19K Ω.
PM24	A/O	**PM24A**	O	Change base, if necessary.
PM24B	O	**PM24M**	O	Redesign circuit. PM24M : Va=Vg2=250V max.
PM24C	O	**PM24M**	O	Redesign circuit. PM24M : Va=Vg2=250V max.
PM252	A	**PM2A**	A	Change Vg1 to −6V. Ra=7K Ω.
PP4s	P	**PM24M**	O	Change base.
PP34	M	**PEN36C**	M	Connect g1 to T.C.
PP36	M	**PEN36C**	M	Rewire base.
PT4D	M	**PEN4DD**	M	Rewire base.
PTZ	M	**PEN36C**	M	Rewire base.
PV29s	P	**UR3C**	M	Change base.
PV30s	P	**UR3C**	M	Change base.
PVB6s	P	**EZ35**	K	Change base. Check Ih when series heated.
P220 (Tungsram)	A	**PM202**	A	Bias may require adjustment.
QP240 (Mazda)	9-pin	**QP22B**	M	Change base.
QP240 (Hivac)	M	**QP22B**	M	Bias may require adjustment.
QPT2	M	**QP22B**	M	Bias may require adjustment.
RV120/500s	P	**DW4/500**	A	Change base.
SP4 (Tungsram)	M	**SP4**	M	Rewire base.
SP4C	P	**SP4B**	M	Change base.
SP6s	P	**EF37A**	K	Change base.
SP13 (Tungsram)	M	**SP13**	P	Change base.
SP22	MO	**SP2**	M	Change base.
SP215	M	**SP2**	M	Bias may require adjustment.
SS210	A	**PM12M**	A	Raise Vg2 to 90V.
S21	A	**PM12M**	A	Raise Vg2 to 90V.
S22	A	**PM12M**	A	Raise Vg2 to 90V.
S23	A	**PM12M**	A	Raise Vg2 to 90V.
S24	A	**PM12M**	A	Raise Vg2 to 90V.
S30D	A	**ACO44**	A	Change Vf to 4V.
S215	A	**PM12M**	A	Raise Vg2 to 90V.
S215A	A	**PM12M**	A	Raise Vg2 to 90V.
S215B	A	**PM12M**	A	Raise Vg2 to 90V.
S434N (5-pin)	O	**VP4A**	M	Change base.
S1324	M	**SP13C**	M	Raise Vg2 to Va.
TDD2	O	**TDD2A**	O	Change Vg1 to −1·5V. Not suitable as Class B driver.
TDD13	P	**TDD13C**	M	Change base.
TH4	M	**TH4B**	M	Change Rk to 140 Ω. Grid leak to be increased to 50K Ω between grid and cathode.

Type Number	BASE	Mullard Replace-ment	BASE	CONVERSION
TH41	MO	**TH4B**	M	Change base. Receiver may require re-aligning.
TH62	K	**CCH35** / **ECH35**	K	For AC/DC receivers—CCH35. For AC receivers—ECH35.
TH233	MO	**TH30C**	M	Change base. Receiver may require re-aligning.
TP25	MO	**KCF30**	K	Change base.
TT4	O	**EC31**	K	Change base. Raise Vh to 6·3V.
TV4	P	**EM1**	P	Raise Vh to 6·3V.
TX4	M	**TH4B**	M	Change Rk to 140Ω. Grid leak to be increased to 50KΩ between grid and cathode.
UAF41	B8A	**UAF42**	B8A	Connect pins 4 and 7 together.
UCH4	K	**UCH21**	B8G	Change base.
UCH41	B8A	**UCH42**	B8A	Screen grid resistor may need alteration.
UR2	P	**UR3C**	M	Change base.
UR3	P	**UR3C**	M	Change base.
UU6	MO	**IW4/350**	A	Change base.
UU8	MO	**GZ32**	K	Change base. GZ32, Vh=5V.
UY31	K	**UY21**	B8G	Change base.
U50	K	**GZ32**	K	GZ32 has indirectly heated cathode.
U82	B8G	**EZ35**	K	Change base.
U84	B8G	**AZ31**	K	Change base.
U101	B8G	**UY21**	B8G	Join pins 2, 4 and 6 together.
U149	B8G	**EZ35**	K	Change base.
U403	MO	**CY31**	K	Change base. Check Ih=0·2A.
U4020	O	**URIC**	O	Check Ih=0·2A.
VHTA	M	**FC13C**	M	Vg2 max.=90V. Receiver may require realigning.
VM4V	O	**VP4**	O	Volume control less gradual in operation.
VMP4G	M	**VP4A**	M	Bias may require adjustment.
VMS4	O	**VP4**	O	Volume control will be less gradual in operation.
VMS4B	O	**VP4**	O	Volume control will be less gradual in operation.
VP4C	M	**VP4B**	M	Rewire base.
VP13	M	**VP13A**	P	Change base.
VP22	MO	**KF35**	K	Change base.
VP41 (Mazda)	MO	**VP4B**	M	Change base.
VP133	MO	**VP13C**	M	Change base. Bias may require adjustment.
VP210	M	**KF35**	K	Change base.
VP215	M	**VP2**	M	Increase Vg2 to Va.
VP1321	M	**VP13C**	M	Change base connections.
VPT2	M	**VP2**	M	Increase Vg2 to Va.
VX2s	P	**VP2B**	M	Change base.
V30	O	**URIC**	O	Check Ih=0·2A.

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Type Number	BASE	Mullard Replace-ment	BASE	CONVERSION
W21	M	**VP2**	M	Join pins 3 and 4 together.
W42	M	**VP4A**	M	Rewire base.
W63	K	**EF39***	K	Bias may require adjustment.
X42	M	**FC4**	M	Bias may require adjustment.
X65	K	**ECH35**	K	Earth pin 1. Receiver may require re-aligning.
YD2	A	**PM2A**	A	Bias may require adjustment.
Y61	K	**EM34**	K	Supply a2 (pin 6) from H.T., through 1M Ω resistor.
Y62	K	**EM34**	K	
Y63	K	**EM34**	K	Interchange connections, to pins 4 and 5.
Y220	O	**PM22A**	O	Bias may require adjustment.
Z21	M	**SP2**	M	Earth pin 3.
1A4E	UX	**KF35**	K	Change base.
1A4P	UX	**KF35**	K	Change base.
1A7G	K	**DK32**	K	Earth pin 1.
1C6	UX	**KK32**	K	Change base.
1C7G	K	**KK32**	K	Earth pin 1.
1D5	O	**UR1C**	O	Check Ih=0·2A.
1D6	UX	**PY31**	K	Change base. Check Ih=0·3A.
1D7G	K	**KK32**	K	Earth pin 1.
1E5G	K	**KF35**	K	Earth pins 1 and 5.
1F4	UX	**KL35**	K	Change base.
1H6G	K	**KBC32**	K	Rewire base.
1LA6	B8G	**DK32**	K	Change base.
1LC5	B8G	**DF33**	K	Change base.
1LD5	B8G	**DAF91**	B7G	Change base.
1LH4	B8G	**DAC32**	K	Change base.
1LN5	B8G	**DF33**	K	Change base.
1N5G	K	**DF33**	K	Change base.
1S4	B7G	**DL92**	B7G	Rewire base so that Vf is between pin 5 and pins 1 and 7 connected together.
1U5	B7G	**DAF91**	B7G	Rewire base.
2D4	O	**2D4A**	O	Rewire base. 2D4A has no top-cap.
2D13	V	**EB34**	K	Change base, when rewiring connect cathodes of EB34 together. EB34 : Vh =6·3V.
2D13A	V	**EB34**	K	
2D13C	O	**EB34**	K	
3Q4	B7G	**DL94**	B7G	Rewire base.
4D1	M	**HL13C**	M	Earth pin 1.
4THA	M	**TH4B**	M	Receiver may require realigning.
5Y3G	K	**GZ32**	K	GZ32 is indirectly heated.
5Y4G	K	**GZ32**	K	Rewire base. GZ32 is indirectly heated.
6A6	UX	**ECC33**	K	Change base. ECC33 unsuitable for use as Class B output valve.
6A7	UX	**EK32***	K	Change base. Earth pin 1. Receiver may require realigning.
6A7E	UX	**EK32***	K	

* *See note at the beginning of Direct Equivalent Guide.*

Type Number	BASE	Mullard Replacement	BASE	CONVERSION
6A8G	K	**EK32***	K	Earth pin 1. Receiver may require realigning.
6A8GT	K	**EK32***	K	Receiver may require realigning.
6AK6	B7G	**EL91**	B7G	Rewire base.
6AT6	B7G	**EBC41**	B8A	Change base.
6BD6	B7G	**EF41***	B8A	Change base.
6BT6	B7G	**EBC41***	B8A	Change base.
6C6	UX	**EF37A***	K	Change base.
6D6	UX	**EF39***	K	Change base.
6J7G	K	**EF37A***	K	Earth pin 1.
6J8G	K	**ECH35**	K	Earth pin 1. Bias may require adjustment.
6K7G	K	**EF39***	K	Earth pin 1.
6K8G	K	**ECH35**	K	Earth pin 1. Receiver may require realigning.
6K8GT	K	**ECH35**	K	Receiver may require realigning.
6L6G	K	**EL37**	K	Bias may require adjustment.
6N7GT/G	K	**ECC33**	K	Rewire base. ECC33 unsuitable as Class B output valve.
6P28	K	**EL38**	K	Rewire base.
6Q7G	K	**EBC33***	K	Earth pin 1. Bias may require adjustment.
6Q7GT	K	**EBC33***	K	Bias may require adjustment.
6S7G	K	**EF39***	K	Earth pin 1.
6SC7	K	**ECC35***	K	Rewire base.
6SJ7	K	**EF36***	K	Rewire base.
6SK7	K	**EF41***	B8A	Change base.
6SN7GT	K	**ECC33**	K	Bias may require adjustment.
6U5/6G5	UX	**EM34***	K	Change base. Supply a2 from H.T. through 1 MΩ resistor.
6U7G	K	**EF39***	K	Earth pin 1.
6V6G	K	**EL33**	K	Bias may require adjustment.
6W7G	K	**EF37A***	K	Earth pin 1.
6ZY5G	K	**EZ35**	K	EZ35 Ih=0·6A, 6ZY5G Ih=0·3A.
7A7	B8G	**EF22***	B8G	Bias may require adjustment.
7B7	B8G	**EF22***	B8G	Bias may require adjustment.
7C5	B8G	**EL41**	B8A	Change base. Bias may require adjustment.
7F7	B8G	**ECC35***	K	Change base.
7K7	B8G	**EBC41**	B8A	Change base.
7S7	B8G	**ECH21***	B8G	Rewire base. Receiver may require realigning.
7Y4	B8G	**EZ35**	K	Change base.
8D2	M	**SP13C**	M	Increase Vg2 to Va.
9D2	M	**VP13C**	M	Earth pin 1. Raise Vg2 to 200V.
10D1	O	**EB34**	K	Change base. When rewiring connect cathodes of EB34 together. EB34 : Vh =6·3V.

**See note at the beginning of Direct Equivalent Guide.*

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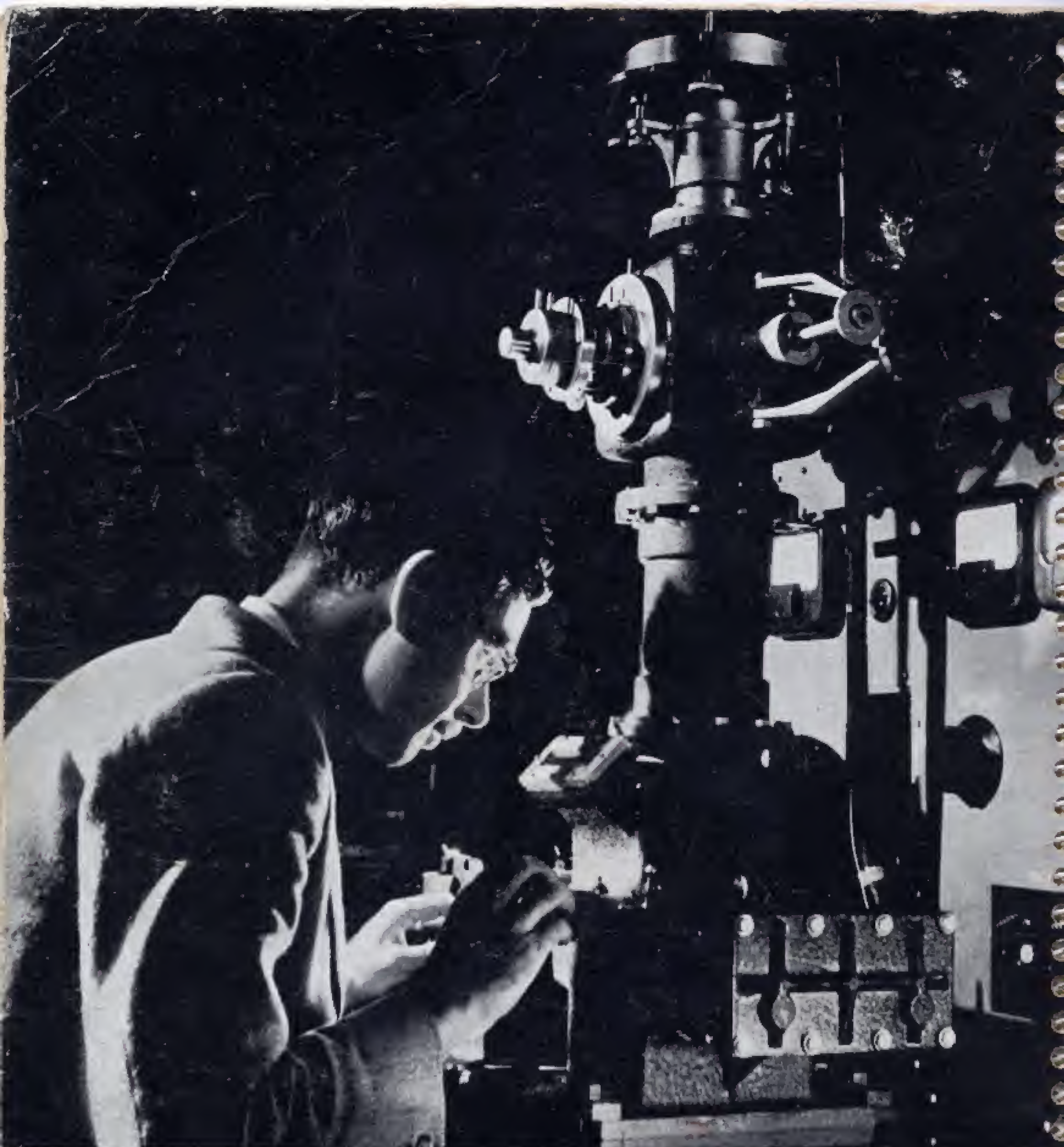
Type Number	BASE	Mullard Replacement	BASE	CONVERSION
11A2	M	**TDD4**	M	Earth pin 2. Bias may require adjustment.
12Z3	UX	**PY31**	K	Change base. Check Ih=0·3A.
13PGA	M	**FC13C**	M	Vg2 max.=90V.
13SPA	M	**SP13C**	M	Increase Vg2 to Va.
13VPA	M	**VP13C**	M	Increase Vg2 to Va.
15	UX	**KF35**	K	Change base.
15A2	M	**FC4**	M	Vg2 max.=90V.
15D1	M	**FC13C**	M	Vg2 max.=90V.
25RE	UX	**PY31**	K	Change base. Check Ih=0·3A. Only suitable as half-wave rectifier.
25Y5	UX	**PY31**	K	Change base. Check Ih=0·3A. Only suitable as half-wave rectifier.
25Z4G	K	**PY31**	K	Check Ih=0·3A.
25Z5	UX	**PY31**	K	Change base. Check Ih=0·3A. Only suitable as half-wave rectifier.
25Z6G	K	**PY31**	K	Rewire base. Check Ih=0·3A. Only suitable as half-wave rectifier.
35RE	UX	**PZ30**	K	Change base. Check Ih=0·3A.
36	UX	**EF36***	K	Change base.
39/44	UX	**EF39***	K	Change base.
40SUA	O	**UR1C**	O	Check Ih=0·2A.
41E	UX	**EL32**	K	Change base.
41STH	M	**TH4B**	M	Bias may require adjustment.
42/42E	UX	**EL32**	K	Change base.
451U	A	**FW4/500**	A	FW4/500 is directly heated.
77/77E	UX	**EF37***	K	Change base.
78/78E	UX	**EF39***	K	Change base.
80	UX	**GZ32**	K	Change base.
84/6Z4	UX	**EZ35**	K	Change base.
210LF	A	**PM2HL**	A	Bias may require adjustment.
210SPT	M	**SP2**	M	Increase Vg2 to Va.
210VPT (4-pin)	O	**VP2**	M	Change base. Increase Vg2 to Va.
210VPT (7-pin)	M	**VP2**	M	Increase Vg2 to Va.
215P	A	**PM2A**	A	Increase Vg1 to −6V.
220P	A	**PM2A**	A	Bias will require adjustment.
220SG	A	**PM12M**	A	Increase Vg2 to 90V.
230PT	A/O	**PM22A**	A/O	Change Vg1 to −4·5V at Va=Vg2=135V and Ra to approximately 19K Ω.
230XP	A	**PM202**	A	Bias may require adjustment.
484V	O	**354V**	O	Change Vg1 to −4·5V or Rk to 700 Ω.
2101	UX	**KL35**	K	Change base.
2102	UX	**KBC32**	K	Change base.

* *See note at the beginning of Direct Equivalent Guide.*



TECHNICAL DATA

Mullard